

PATENT

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APPLICATION FOR PATENT

ON

*POWER TOOL CONTROL SYSTEM*

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*POWER TOOL CONTROL SYSTEM*CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present invention is a continuation-in-part of United States Application Serial Number 10/744,612, filed on December 23, 2003, which is a continuation-in-part of United States Application Serial Number 10/632,559, filed on July 31, 2003, which is a continuation of United States Application Serial Number 10/463,206, filed on June 16, 2003 which is a continuation-in-part of United States Application 10/445,290, filed on May 21, 2003, which claimed priority under 35 U.S.C. §119 to United States Provisional Application Serial Number 60/429,840, filed on November 27, 2002, and United States Application Serial Number 10/413,455, filed on April 14, 2003 which claimed priority under 35 U.S.C. §119 to United States Provisional Application 60/414,200, filed on September 27, 2002 and United States Provisional Application 60/373,752, filed on April 18, 2002. The United States Applications, Serial Number 10/744,612, 10/632,559, 10/463,206, 10/445,290, 60/429,840, 10/413,455, 60/414,200, and 60/373,752, are herein incorporated by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention generally relates to the field of power tools, and particularly to a power tool control system for use with a variety of power tools, such as table saws, routers, and the like.

BACKGROUND OF THE INVENTION

[0003] Power tools are used to accomplish a variety of tasks. No matter the task, the production of accurate and precise work is a high priority. Unfortunately, the precision and accuracy of work performed on these power tools is limited by human error and sub-standard equipment. Even when equipment with the latest advances, such as laser guidance technology, is employed it is often the case that the use of such technology is difficult for the equipment operator. The difficulties experienced by an operator may be due to a variety of reasons, such as inadequate instructional aids available from the

manufacturer or dealer, overly complex operational requirements, or a poorly designed and organized user interface. Such difficulties have rendered many valuable advances in tool technology unpopular or obsolete due to operator dissatisfaction and frustration.

[0004] Many power tools today have incorporated guidance mechanisms, such as laser guidance technology, into their power tool assembly. These mechanisms assist an operator in identifying and maintaining an accurate work product as the power tool executes a function upon a work piece. However, the operator is still required to establish the location of operation and this may result in imprecise and inaccurate work piece production due to imprecise measurements and settings established by the operator. Further, it is often necessary to perform different functions and then return to previous settings. Consequently, the operator is forced to establish and then re-establish settings, which may lead to further imprecision and inaccuracy in the work product produced due to operator error.

[0005] Additionally, the use of advanced technology such as the laser guidance systems often provide user interface technology which is limited in capabilities, lacks a coherent and easily understood organizational structure for the information it gathers and provides to the operator, and makes accessing the information made available by its use difficult due to low quality display mechanisms and user interaction assemblies. Many of the difficulties experienced by operators when employing the user interface devices may primarily result from a focus on the technology and not the user. For example, the user interface may provide the ability to access numerous features but have a display mechanism that is so cluttered that it becomes burdensome to decipher the relevant information. Many times, to correct for this problem, the user interface is stripped of numerous capabilities and the user is left with insufficient resources to accomplish their tasks.

[0006] Therefore, it would be desirable to provide a power tool control system that enables a power tool operator to establish precise and accurate measurements and settings for a power tool and provide a user friendly user interface assembly in order to ensure work product of a high quality.

#### SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is a power tool control system that enables a user to operate a power tool through a graphical user interface communicatively coupled with a non-contact measurement and alignment device. The graphical user interface correlates user engageable selectors with a logically related menu of power tool setting options displayed on a display screen in a high quality and easily readable format. The non-contact measurement and alignment device uses one or more lasers to determine power tool settings and establish proper alignment based on user needs.

[0008] In an additional aspect, the present invention includes a bevel indication assembly for use with a table saw assembly. The bevel indication assembly provides a visual indication of the beveled angle setting of a saw blade of the table saw assembly. The visual indication assists the user of the table saw assembly in establishing desired beveling of the saw blade.

[0009] In a still further aspect, the present invention includes a router bit height indication assembly which establishes a visual indication of the bit height of a router coupled with a router table of a router table assembly. The router bit height indication assembly may provide a visual indication as a marker on an indicator. Additionally, the bit height may be provided through a display on a screen of a graphical user interface.

[0010] The present invention further includes a level which utilizes a laser source to emit a laser beam for the establishment of measurement and alignment settings. The level may further be enabled to provide measurement and alignment settings on multiple axis



of orientation. Additionally, the level may be communicatively coupled with a graphical user interface for the display of the measurement and alignment settings established by the laser beam.

[0011] The graphical user interface is configured with multiple display screen aspect capabilities in order to increase the intuitive control of the graphical user interface and thus the power tool it is communicatively coupled with. The display screen presents the user options for display configuration, such as single-cell screen, dual-cell screen, tri-cell screen, and the like, in order to present information with increased ease of viewing to the user. Each screen configuration, described above, may be further configured to provide one or more further aspects. For instance, in a dual cell configuration, a first cell may be further defined by a first and second sub-cell and a second cell may include a first, second, and third sub-cell. It is understood that the above description is exemplary and various configurations as contemplated by those of ordinary skill in the art may be employed without departing from the scope and spirit of the present invention.

[0012] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as claimed. The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate an embodiment of the invention and together with the general description, serve to explain the principles of the invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The numerous advantages of the present invention may be better understood by those skilled in the art by reference to the accompanying figures in which:

FIG. 1 is an illustration of a laser apparatus including a computing system in accordance with an exemplary embodiment of the present invention;

FIG. 2 is an illustration of the laser apparatus showing alternative power supply embodiments;

FIGS. 3 and 4 illustrate the computing system shown in FIG. 1, including display screens;

FIG. 5 is an illustration of the computing system showing alternative power supply embodiments;

FIG. 6 is an illustration of the laser apparatus coupled to a leveling assembly in accordance with an exemplary embodiment of the present invention;

FIG. 7 is an illustration of a laser apparatus coupled to a level assembly and in communication with a remote computing system;

FIG. 8 is an isometric illustration of a table saw system including the laser apparatus shown in FIG. 1 coupled to a fence connected to a table saw emitting three laser beams;

FIG. 9 is a top plan view of the table saw system of FIG. 8 illustrating the laser apparatus emitting three laser beams for establishing distance measurements in accordance with an exemplary embodiment of the present invention;

FIG. 10A is a side elevation view of the table saw system of FIG. 8 illustrating the laser apparatus emitting a single laser beam for establishing a distance measurement;

FIG. 10B is a top plan view of the table saw system of FIG. 8 illustrating the laser apparatus emitting three laser beams for establishing blade height measurements in accordance with an exemplary embodiment of the present invention;

FIG. 10C is a side elevation view of the table saw system of FIG. 8 illustrating the laser apparatus emitting a single laser beam for establishing a blade height measurement;

FIG. 11A is an isometric illustration of the table saw system of FIG. 8 employing three laser beams for establishing the beveled angle of the blade;

FIG. 11B is an isometric illustration of the table saw system of FIG. 8 employing a single laser beam for establishing the beveled angle of the blade;

FIG. 12A is a first exemplary embodiment illustrating a bevel indication assembly for use with a table saw, the bevel indication assembly including a laser source coupled with an adjustment flange and a visual marker coupled with the table saw assembly;

FIG. 12B is a second exemplary embodiment illustrating a bevel indication assembly for use with a table saw, the bevel indication assembly including a laser source coupled with an adjustment flange and an indicator remote from the table saw;

FIG. 13 is an illustration of a laser light indicia and reading assembly coupled with a computing system in accordance with an exemplary embodiment of the present invention;

FIG. 14 is an illustration of the laser light indicia and reading assembly coupled to a level assembly, the computing system being coupled to the level assembly and in communication with the laser scanning apparatus;

FIGS. 15A, 15B, and 15C illustrate a known scanning module which may be employed in the laser light indicia and reading assembly in accordance with an exemplary embodiment of the present invention;

FIG. 16 is a top plan view of a known scanning module employing a dithering assembly;

FIG. 17 is an illustration of a known dithering assembly employing a drive coil and drive magnet to provide mirror oscillation;

FIG. 18 is an illustration of a known dithering assembly employing travel stops to control the range of rotational travel imparted to the mirror;

FIG. 19 is an illustration of a known dithering assembly employing pads connected to drive and feedback magnets to control the range of rotational travel imparted to the mirror;

FIG. 20 is an illustration of the laser light indicia and reading assembly coupled with a table saw and establishing a laser light cut line;

FIG. 21 is an illustration of the laser light indicia and reading assembly coupled with the table saw and establishing a laser light cut line on a work piece;

FIG. 22A is a side elevation view illustrating the laser light indicia and reading assembly coupled with the table saw and establishing a blade height measurement;

FIG. 22B is a front plan view illustrating the laser light indicia and reading assembly coupled with the table saw and establishing the blade height measurement;

FIG. 23 is an illustration of a plurality of laser light indicia and reading assemblies coupled with the table saw and establishing a blade height measurement;

FIG. 24A is an isometric illustration of the laser light indicia and reading assembly coupled with the table saw and establishing the beveled angle of the blade;

FIG. 24B is a front plan view illustrating the laser light indicia and reading assembly coupled with the table saw and establishing the beveled angle of the blade;

FIG. 24C is an illustration of a plurality of laser light indicia and reading assemblies coupled with the table saw and establishing the beveled angle of the blade;

FIG. 25 is a flowchart illustrating functional steps which are accomplished by the laser apparatus and the laser light indicia and reading assembly of the present invention;

FIG. 26 is an illustration of a laser apparatus connected to a fence on a table saw, whereupon each laser source includes a dithering assembly;

FIG. 27 is an illustration of multiple laser light indicia and reading assemblies connected to a table saw emitting a laser beam grid produced by laser sources with dithering assemblies;

FIG. 28A is an illustration of the multiple laser light indicia and reading assembly connected to the table saw emitting the laser beam grid and establishing a blade height measurement;

FIG. 28B is a top plan view illustrating the grid and blade height measurement capabilities of the multiple laser light indicia and reading assembly connected to the table saw;

FIG. 29A is an illustration of the multiple laser light indicia and reading assembly connected to the table saw emitting the laser beam grid and establishing the beveled angle of the blade;

FIG. 29B is an top plan view illustrating the grid and beveled angle measurement capabilities of the multiple laser light indicia and reading assembly connected to the table saw;

FIG. 30 is an isometric illustration of a rotating laser apparatus including a

computing system and rotation assembly in accordance with an exemplary embodiment of the present invention;

FIG. 31 is an illustration of the rotating laser apparatus including a display menu and an angle measurement device;

FIGS. 32 and 33 illustrate the rotation assembly including the angle of measurement device and a lock and release unit operable by the user;

FIG. 34 is an illustration of the rotating laser apparatus in operation;

FIG. 35 is an illustration of the rotating laser apparatus with laser beams produced by laser sources with dithering assemblies;

FIGS. 36 and 37 are illustrations of a computing system of the laser apparatus showing display menus available;

FIG. 38 is a flowchart illustrating functional steps which are accomplished by the rotating laser apparatus;

FIG. 39 is an illustration of a laser apparatus with a single laser source providing a laser beam which is split to emit separate laser beams from the laser beam source assemblies located within the housing by optical splitters;

FIG. 40 is an illustration of the laser apparatus coupled with a computing system, that provides a single laser beam which is split to emit separate laser beams from the laser beam source assemblies located within the housing by optical splitters;

FIG. 41 is an illustration of a rotating laser apparatus with a single laser source;

FIG. 42 is an illustration of a rotating laser apparatus with a first and a second laser source;

FIG. 43 is an illustration of the laser apparatus in FIG. 39, including a plurality of photo multipliers disposed within a housing of the laser apparatus;

FIG. 44 is an illustration of a laser apparatus including a leveling mechanism in accordance with an exemplary embodiment of the present invention;

FIG. 45 is an illustration of a plurality of the laser apparatus, shown in FIG. 44, coupled with one another;

FIG. 46 is an illustration of the laser apparatus in FIG. 44, providing leveling readings to a drop ceiling assembly;

FIG. 47 shows an exemplary home screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 48 shows an exemplary settings screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 49 shows an exemplary calibration screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 50 shows an exemplary save screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 51 shows an additional exemplary save screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 52 shows a further exemplary save screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 53 shows a still further exemplary save screen shown on a display of an exemplary user interface in accordance with an exemplary embodiment of the present invention;

FIG. 54 shows an exemplary scheme according to which a user interface may operate in accordance with an exemplary embodiment of the present invention;

FIG. 55 shows an exemplary user interface with different screens in accordance with an exemplary embodiment of the present invention, which user interface may execute the scheme shown in FIG. 54;

FIG. 56 shows an exemplary calibration screen in accordance with an exemplary embodiment of the present invention;

FIG. 57 shows an additional exemplary calibration screen in accordance with an exemplary embodiment of the present invention;

FIG. 58 illustrates an exemplary home screen in accordance with an exemplary embodiment of the present invention;

FIG. 59 illustrates various exemplary screens in a distance mode in accordance with an exemplary embodiment of the present invention;

FIG. 60 illustrates various exemplary screens in an angle mode in accordance with an exemplary embodiment of the present invention;

FIG. 61 illustrates various exemplary screens in a height mode in accordance with an exemplary embodiment of the present invention;

FIG. 62 illustrates various exemplary screens in a settings mode in accordance with an exemplary embodiment of the present invention;

FIG. 63 shows an exemplary distance screen in accordance with an exemplary embodiment of the present invention;

FIG. 64 shows an exemplary distance fine adjustment screen in accordance with an exemplary embodiment of the present invention;

FIG. 65 shows an exemplary distance relative zero screen in accordance with an exemplary embodiment of the present invention;

FIG. 66 shows an exemplary default distance units screen in accordance with an exemplary embodiment of the present invention;

FIG. 67 shows an exemplary distance decimal unit screen in accordance with an exemplary embodiment of the present invention;

FIG. 68 shows an exemplary distance offset screen in accordance with an exemplary embodiment of the present invention;

FIG. 69 shows an exemplary distance recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 70 shows an additional exemplary distance recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 71 shows a further exemplary distance recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 72 shows a still further exemplary distance recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 73 shows an exemplary distance save screen in accordance with an exemplary embodiment of the present invention;

FIG. 74 shows an additional exemplary distance save screen in accordance with an exemplary embodiment of the present invention;

FIG. 75 shows an exemplary angle screen in accordance with an exemplary embodiment of the present invention;

FIG. 76 shows an exemplary angle fine adjustment screen in accordance with an exemplary embodiment of the present invention;

FIG. 77 shows an exemplary angle zero screen in accordance with an exemplary embodiment of the present invention;

FIG. 78 shows an exemplary angle relative zero screen in accordance with an exemplary embodiment of the present invention;

FIG. 79 shows an exemplary angle recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 80 shows an additional exemplary angle recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 81 shows a further exemplary angle recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 82 shows an exemplary angle save screen in accordance with an exemplary embodiment of the present invention;

FIG. 83 shows an additional exemplary angle save screen in accordance with an exemplary embodiment of the present invention;

FIG. 84 shows an exemplary height screen in accordance with an exemplary embodiment of the present invention;

FIG. 85 shows an exemplary height fine adjustment screen in accordance with an exemplary embodiment of the present invention;



FIG. 86 shows an exemplary height absolute zero screen in accordance with an exemplary embodiment of the present invention;

FIG. 87 shows an exemplary default height units screen in accordance with an exemplary embodiment of the present invention;

FIG. 88 shows an exemplary height decimal unit screen in accordance with an exemplary embodiment of the present invention;

FIG. 89 shows an exemplary height offset screen in accordance with an exemplary embodiment of the present invention;

FIG. 90 shows an exemplary height recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 91 shows an additional exemplary height recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 92 shows a further exemplary height recall screen in accordance with an exemplary embodiment of the present invention;

FIG. 93 shows an exemplary height save screen in accordance with an exemplary embodiment of the present invention;

FIG. 94 shows an additional exemplary height save screen in accordance with an exemplary embodiment of the present invention;

FIG. 95 shows an exemplary settings screen in accordance with an exemplary embodiment of the present invention;

FIG. 96 shows an exemplary default global units screen in accordance with an exemplary embodiment of the present invention;

FIG. 97 shows an exemplary global metric units screen in accordance with an exemplary embodiment of the present invention;

FIG. 98 shows an exemplary system screen in accordance with an exemplary embodiment of the present invention;

FIG. 99 shows an exemplary sound screen in accordance with an exemplary embodiment of the present invention;

FIG. 100 shows an exemplary brightness screen in accordance with an exemplary embodiment of the present invention;

FIG. 101 shows an exemplary laser time out screen in accordance with an exemplary embodiment of the present invention;

FIG. 102 is a perspective view illustrating a user interface operationally coupled with a laser apparatus including a laser source, the laser apparatus coupled with a fence of a table saw assembly;

FIG. 103 is a perspective view illustrating a laser light indicia and reading assembly coupled with the user interface;

FIG. 104 is a perspective view illustrating a multiple laser light indicia and reading assemblies coupled with the user interface;

FIG. 105 is a perspective view illustrating a bevel indication assembly coupled with an imaging device and the user interface;

FIG. 106 is a perspective view illustrating a bevel indication assembly coupled with a sensor assembly and the user interface;

FIG. 107 illustrates an integrated laser table saw assembly in accordance with a first exemplary embodiment of the present invention including a table coupled with an integrated laser assembly operationally coupled with a user interface;

FIG. 108 is an expanded view of the integrated laser assembly including a laser source for emitting a laser beam through a plurality of lenses;

FIG. 109A is a perspective view of the integrated laser table saw assembly establishing a blade height measurement reading and the user interface displaying the reading; LIKE 107 ONLY ENLARGE THE SCREEN ON UI

FIG. 109B illustrates the user interface operationally coupled with the integrated laser assembly and a secondary computing system, for receiving, displaying, and transmitting information;

FIG. 110 is a perspective view illustrating a second exemplary embodiment of an integrated laser table saw assembly wherein the integrated laser assembly includes a

plurality of laser sources for emitting a plurality of laser beams through a plurality of lenses;

FIG. 111 is a perspective view of the integrated laser table saw assembly of FIG. 110, wherein a user interface is operationally coupled with a secondary computing system and the integrated laser assembly for receiving, displaying, and transmitting information, such as establishing a beveled angle measurement reading;

FIG. 112A is an isometric illustration of a router table assembly including a table coupled with a router, the router operationally engaging a bit and disposed with an integral laser apparatus, the integral laser apparatus including a laser source emitting a single laser beam onto a first exemplary router bit height indicator;

FIG. 112B is a side elevation view illustrating the router table assembly including a table coupled with a router, the router operationally engaging a bit and disposed with an integral laser apparatus, the integral laser apparatus including a laser source emitting a single laser beam onto a second exemplary router bit height indicator;

FIG. 113 is a perspective view of a router table assembly including a table coupled with a router, the router operationally engaging a bit and disposed with a laser light indicia and reading apparatus, the laser light indicia and reading apparatus including a laser source emitting a single laser beam onto a first exemplary router bit height indicator;

FIG. 114 is an illustration of a router table assembly including a table coupled with a router, the router operationally engaging a bit and disposed with a laser light indicia and reading apparatus, the laser light indicia and reading apparatus being communicatively coupled with a user interface and a imaging device for identifying and displaying, to a user of the router table assembly, bit height;

FIG. 115 is an illustration of a router table assembly including a table coupled with a router, the router operationally engaging a bit and disposed with an integral laser apparatus, the integral laser apparatus including a laser source emitting a single laser beam onto a bit height sensor assembly which is communicatively coupled to a user interface;

FIGS. 116A is an isometric illustration of a router table assembly including a table coupled with a router, the router operationally engaging a bit, coupled with the table is a first exemplary bit height indication assembly including an optical assembly comprising a laser source and a laser sensor, the laser source for emitting a single laser beam which operationally contacts the laser sensor, the laser source and laser sensor are communicatively coupled to a user interface to provide information;

FIG. 116B is a side elevation view of the router table assembly of FIG. 116A;

FIG. 117A is an isometric illustration of a router table assembly including a table coupled with a router, the router operationally engaging a bit, coupled with the table is a second exemplary bit height indication assembly including an optical assembly comprising a laser source and a laser sensor, the laser source for emitting multiple laser beams which operationally contact with the laser sensor, the laser source and laser sensor are communicatively coupled to a user interface to provide information;

FIG. 117B is an illustration of the router table assembly shown in FIG. 117A including a docking station for coupling with the user interface;

FIG. 118 is an isometric illustration of a router table assembly including a table coupled with a router, the table being further disposed with a first exemplary embodiment of an integrated laser assembly including a laser source and laser sensor, the laser source for emitting one or more laser beams which operationally engage with the laser sensor, the integrated laser assembly being communicatively coupled with a user interface;

FIG. 119 is a perspective view of the router table assembly including the first exemplary integrated laser assembly wherein the user interface is remotely located from the table and shown to be capable of displaying various information, such as router bit height information;

FIG. 120 is a perspective view illustrating a second exemplary embodiment of an integrated laser assembly, for use with a router table assembly, wherein the integrated laser assembly includes a plurality of laser sources for emitting a plurality of laser beams which operationally engage with a plurality of laser sensors;

FIG. 121 is an isometric illustration of a laser level apparatus in accordance with

an exemplary embodiment of the present invention;

FIG. 122 is a top plan view of the laser level apparatus;

FIG. 123 is a front plan view of the laser level apparatus;

FIG. 124 is a side elevation view of the laser level apparatus;

FIG. 125 is a bottom plan view of the laser level apparatus;

FIG. 126 is a side elevation perspective view illustrating a laser source and lens assembly of the laser level apparatus;

FIG. 127 is an isometric illustration of a second exemplary embodiment of the laser level apparatus including an angle indication assembly;

FIG. 128 is a perspective view of the laser level apparatus of FIG. 127 engaged upon a surface;

FIG. 129 is an isometric view of a user interface in accordance with an exemplary embodiment of the present invention wherein the user interface is in a screen mode which enables the user interface to establish a plurality of screen configurations through user selection;

FIG. 130 is an isometric view of the user interface of the present invention wherein the user interface is in a units mode which enables the user interface to establish reading and measurement data in a plurality of formats through user selection;

FIG. 131 is an isometric view of the user interface of the present invention wherein the user interface is enabled in a laser mode which enables the user interface to present information received from a plurality of optical assemblies, such as the lasers employed in the bevel indication assemblies and the router bit height indication assemblies of the present invention, through user selection;

FIG. 132 is an isometric view of the user interface of the present invention wherein the user interface is enabled in a camera mode which enables the user interface to display information received from such devices as the imaging assembly, through user selection;

FIG. 133 is an isometric view of the user interface of the present invention wherein the user interface is enabled in a table saw mode;

FIG. 134 is an isometric view of the user interface in the table saw mode presenting information in a dual-cell screen configuration which is enabled by user selection of the information desired to be displayed;

FIG. 135 is an isometric view of the user interface in the table saw mode wherein saw blade angle information is being presented in the dual-cell screen mode along with user selectable options;

FIG. 136 is an isometric view of the user interface in the table saw mode presenting information in the dual-cell screen configuration which is enabled by user selection of the information desired to be displayed;

FIG. 137 is an isometric view of the user interface in the table saw mode wherein the dual-cell screen is enabled with a camera view display of the table saw along with a data information display regarding the cut being made;

FIG. 138 is an isometric view of the user interface in the table saw mode wherein the dual-cell screen is enabled with a finish cut display and a data information display regarding the cut made;

FIG. 139 is an isometric view of the user interface of the present invention wherein the user interface is enabled in a router mode;

FIG. 140 is an isometric view of the user interface in the router mode presenting information in a dual-cell screen configuration which is enabled by user selection of the information desired to be displayed;

FIG. 141 is an isometric view of the user interface in the router mode wherein the dual-cell screen is enabled with a camera view display of the router along with a data information display;

FIG. 142 is an isometric view of the user interface in the router mode wherein the dual-cell screen is enabled with a finish cut display and a data information display;

FIG. 143 is a power tool control system in accordance with an exemplary embodiment of the present invention;

FIG. 144 is an illustration of the graphical user interface of the power tool control system of FIG. 143 in accordance with an exemplary embodiment of the present invention; and

FIG. 145 is an isometric illustration of the additional exemplary graphical user interface in accordance with the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

[0014] Reference will now be made in detail to the presently preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings.

[0015] Referring generally now to FIGS. 1 through 142, exemplary embodiments of the present invention are shown.

[0016] Referring generally now to FIG. 1, a laser apparatus 100 of the present invention is shown. In the present embodiment, the laser apparatus 100 comprises a housing 102 coupled with a computing system 104. Further, the housing 102 is disposed with an optical assembly including a first laser source 106, a second laser source 108, and a third laser source 110, in the preferred embodiment. Alternatively, the housing 102 may include a greater or fewer number of laser sources in order to meet the needs of a manufacturer or consumer. Each of the three laser sources 106 through 110 is in communication with the computing system 104. In the current embodiment the communicative link is a wireless system, however, alternate systems, such as serial cable, infrared, or the like may be employed.

[0017] In the present embodiment, the laser sources 106 through 110 are enabled to emit infrared laser beams. These laser beams are invisible to the human eye, however, light emitting diodes may be linked to the laser beam in order to provide a visual indicator of the travel of the laser beam. In an alternate embodiment the laser sources may be enabled

to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention.

[0018] Additionally, a first mounting member 112 and a second mounting member 114 are coupled with the housing 102. The number, location, and configuration of the mounting members may vary as contemplated by one of ordinary skill in the art. The mounting members are suitable for connecting the housing 102 to another device such as a power tool. The power tool may be a table saw, a belt sander, a planer, a disc sander, a lathe, a drill press, and the like. In the current embodiment the laser apparatus 100 is shown being suitable for mounting on a fence 116 which would normally be coupled with a table saw. As shown, the mounting members 112 and 114 include a first latch 124 and a second latch 126 which slide through and latch the housing 102 to a mounting assembly, power tool, or other devices. In the current embodiment the first and second latches 124 and 126 are compression latches. However, it is understood that the current latch system may be a variety of latching mechanisms without departing from the scope and spirit of the present invention.

[0019] The latches 124 and 126 are operably coupled with a first release mechanism 120 and a second release mechanism 122, respectively. In the present embodiment, the first and second release mechanisms 120 and 122 are depression buttons, operable by a user by pressing down on the buttons. However, other release mechanisms, such as switches, rotation knobs, or the like, may be employed without departing from the scope and spirit of the present invention. By depressing the buttons 120 and 122 the latches 124 and 126 are retracted into the mounting member upon which they are disposed. This allows the user to engage and remove the housing 102, of the laser apparatus 100, from the mounting assembly, power tool, or other device the user is currently operating. The location and number of release mechanisms may vary as determined by the number of mounting members and latches disposed on the laser apparatus 100.



[0020] The housing further provides the user a first grip 128 and a second grip 130 proximally located next to the buttons 120 and 122. The two grips 128 and 130 are ergonomically shaped to provide the user a secure location with which to grip the housing 102 for depressing the first and second buttons 120 and 122 and releasing the compression latches 124 and 126. The two grips may also be used in transporting the laser apparatus 100.

[0021] It is further contemplated that the laser apparatus 100 may include a laser source which emits an incident laser beam from either a first end 116 or a second end 118 of the housing 102. Such a configuration may be desirable in situations where a user needs only one laser beam to produce a finished work product, such as when working on a lathe machine as shown in FIG. 10. Further, such a configuration may be desirable when employing the optical assembly of the present invention in a laser level apparatus, as shown and described in FIGS. 121 through 128.

[0022] In an alternate embodiment, the three laser beam sources 106, 108, and 110, may comprise modular laser source units. The modular laser source units may be capable of being removed from and inserted into the housing 102. The modular laser source units may be locked in position, once inserted into the housing 102, by use of a variety of system, such as a latch system, compression system, or the like. There may be a variety of modular laser source units disposed with laser sources of varying power. Further, the modular laser source units may include a dithering assembly enabling the laser source to provide dithering functionality. For further discussion on dithering assemblies see FIGS. 21 through 24 below.

[0023] Further, the laser apparatus 100 may be comprised of a single laser source. The single laser source may emit an incident laser beam through the housing 102. The single laser source may be attached at either the first end 116 or the second end 118 of the housing 102. Alternatively, the single laser source may be included in the computing

system 104. In a single laser source configuration optical splitters, optical reflectors, and photomultipliers may be employed in order to facilitate the functional capabilities of the laser apparatus 100. A detailed discussion of the single laser source design, including the use of optical splitters, optical reflectors, and photomultipliers, is provided in FIGS. 36 through 40.

[0024] In the present embodiment, the computing system 104 controls the functioning of each of the three laser sources 106 through 110. A user interacts with the computing system 104 and directs the emitting of a laser beam from each of the three laser sources. Additionally, the computing system 104 monitors the laser beams and provides a display to the user of relevant information.

[0025] The information provided on the display may include distance measurements, blade height measurements, blade angle, and the like. Additionally, the laser beams may provide information regarding the truing of the machine and a work piece, and the indexing of the work piece. For example, in a belt sander apparatus as will be shown and discussed in FIG. 11, the user may ensure that the angle of the sander matches the desired specifications using the laser apparatus. Further, a work piece to be presented to the sander may be verified by the laser apparatus to be in the correct position for presentation to the sander. The laser apparatus may also provide an indexing functionality by determining the leading edge of the work piece and monitoring the distance traveled by the work piece. It is contemplated that other information relevant to a variety of power tools may also be provided by the computing system to the user.

[0026] Referring now to FIG. 2, the laser apparatus 100 is shown. The housing 102 includes a first receptor port 202 suitable for receiving a portable power source 204. The portable power source 204 provides power for the operation of the laser sources disposed within the housing 102. The first receptor port 202 further includes a removable hatch 206 which fastens in place over the opening of the first receptor port 202. The portable

power source 204 may be a variety of devices, such as a rechargeable battery or the like, without departing from the scope and spirit of the present invention.

[0027] Also shown in FIG. 2 is an alternate configuration of the housing 102 where power may be received via a power cord 208 which engages a second receptor port 210. It is understood that typically only one of the above mentioned power source configurations will be employed on the laser apparatus 100 and that FIG. 2 is only an exemplary embodiment of two possible configurations. Further, the location and configuration of the first and second receptor ports 202 and 210 may be varied as contemplated by one of ordinary skill in the art.

[0028] Additionally, a communication port 212 is included in the housing 102 of the laser apparatus 100. The communication port 212 provides a communicative link to the computing system 104, allowing the computing system to communicate with the laser sources 106 through 110 disposed within the housing 102. The location and configuration of the communication port 212 may vary as contemplated by one of ordinary skill in the art without departing from the scope and spirit of the present invention. Further, a first coupling port 214 and a second coupling port 216 are included on the housing 102 for coupling with the computing system 104 as will be further described in FIG. 6.

[0029] FIGS. 3 and 4 show exemplary displays on the computing system 104. Being an interactive system, the computing system 104 includes a first selector 302, a second selector 304, and a third selector 306. The first selector 302 and the third selector 306 allow a user to scroll through choices presented on a display screen 308 of the computing system 104. The second button 304 allows a user to select the desired application choice presented on the display screen 308. For example, in FIG. 3 a user may choose to turn on or turn off the lasers by using the first and third buttons 302 and 306 to select the desired function and then pressing the second button 304 to execute the function. In FIG. 4 the

display screen 308 is providing a user with the readouts determined during the process of truing the machine. The user may accept these dimensions by selecting the "cont." function or reject these dimensions by selecting the "reset" function. It is understood that the displays presented on the display screen 308 are exemplary and may not be read as exclusive. A variety of displays and interactive functionalities may be presented on display screen 308 without departing from the scope and spirit of the present invention.

[0030] Various configurations of the computing system 104 may be employed without departing from the scope and spirit of the present invention. Ergonomic shaping and providing additional capabilities is contemplated. The display screen may be a liquid crystal display, back lit monitor, or the like, while the selector features may include rollers, ball knobs, or the like.

[0031] In the current embodiment, on one end of the computing system 104 are coupled a first button 310 and a second button 312. Preferably, these buttons are depression buttons, however, other systems as contemplated by one of ordinary skill in the art may be employed. The two buttons are used in the coupling and uncoupling of the computing system 104 with the housing 102 of the laser apparatus 100, as will be described in FIGS. 5 and 6.

[0032] In FIG. 5 the computing system 104 includes a first receptor port 502 suitable for receiving a portable power source 504. The portable power source 504 provides power for the operation of the computing system 104 that may be coupled to the housing 102 and is in communication with the laser sources. The first receptor port 502 further includes a removable hatch 506 which fastens in place over the opening of the first receptor port 502. As described for the portable power source 204 of the housing 102, the portable power source 504 may be a variety of devices, such as a rechargeable battery or the like, without departing from the scope and spirit of the present invention. In an alternate configuration the computing system 104 may receive power from a power cord

508 which engages a second receptor port 510. The location and configuration of the first and second receptor ports 502 and 510 may be varied as contemplated by one of ordinary skill in the art.

[0033] Additionally, the computing system 104 includes a first mounting member 512 and a second mounting member 514. These two mounting members couple with the housing 102 of the laser apparatus 104. It is contemplated that a latch and release mechanism is disposed within one of the two mounting members and operably connects with the two buttons 310 and 312. Further, the computing system 104 includes a communication adapter 516 that engages with the communication port 212, shown in FIG. 2, disposed on the housing 102.

[0034] Referring to FIG. 6, the laser apparatus 100 is shown with computing system 104 in vertical orientation over the communication port 212 and the first and second coupling ports 214 and 216. The first and second mounting members 512 and 514, disposed on the computing system 104, are positioned to engage with the first and second coupling ports 214 and 216, respectively. The communication adapter 516 is positioned to engage with the communication port 212. In this preferred embodiment, a user must supply sufficient force to couple the computing system 104 with the housing 102. As discussed above in FIG. 3, the first and second buttons 310 and 312 are operably engaged as part of a latch and release mechanism which locks the computing system 104 in place. A latch or latches may be located on the mounting members 512 and/or 514, and as the computing system 104 is pressed into place they may engage with the inside of the coupling ports 214 and/or 216. In order to remove the computing system 104 from the housing 102, the user will depress one or both of the first and second buttons 310 and 312, which will release the latches from the coupling ports allowing the computing system 104 to release from the housing 102. Other systems may be employed to affix the computing system 104 to the housing 102 without departing from the scope and spirit of the present invention.

[0035] The laser apparatus 100 is shown engaging a mounting assembly 602. Preferably, the mounting assembly 602 includes a leveling device 604. The mounting assembly includes a first mounting port 606, a second mounting port 608, and a third mounting port 610. Initially the mounting assembly 602 is mounted to a power tool or other desired device by using the mounting ports. It is contemplated that the mounting ports may be a variety of configurations as contemplated by one of ordinary skill in the art. Before the laser apparatus 100 is connected a user may establish that the mounting assembly 602 is in a level position by checking the leveling device 604. In this way the user may ensure that the laser apparatus 100 is level once it is connected to the mounting assembly 602. The mounting assembly 602 further includes a first coupling port 612 and a second coupling port 614 which engage the mounting members 112 and 114 of the laser apparatus 100.

[0036] Referring now to FIG. 7, a laser apparatus 700 is shown. The laser apparatus 700 includes a housing member 702 in communication with a remote computing system 703. The housing member 702 is disposed with a first laser source 726, a second laser source 728, and a third laser source 730. Additionally, a mounting assembly 704 capable of connecting with the housing member 702 and providing a communication link between the housing member 702 and the remote computing system 703, is included.

[0037] The housing member 702 is similar to that shown and described in FIGS. 1, 2, and 6, except that the housing member 702 further includes a communication adapter 708 and does not include the communication port shown in FIGS. 2 and 6. The communicative adapter 708 communicatively couples with the remote computing system 703 by engaging the communication adapter 708 in the communicative coupling point 706. This communicative linking allows a user of the laser apparatus 700 to control the laser sources 726 through 730 through the use of the remote computing system 703. Additionally, the housing member includes a first mounting member 732 and a second

mounting member 734. The first mounting member 732 is disposed with a compression latch 736 and is operably engaged with a first depression button 740. The second mounting member 734 is disposed with a compression latch 738 and is operably engaged with a second depression button 742. The first mounting member 732 couples with a first coupling port 744 disposed on the mounting assembly 704, and the second mounting member 734 couples with a second coupling port 746 disposed on the mounting assembly 704. As described previously the first and second depression buttons allow the user to remove the housing member 702 from the mounting assembly 704.

[0038] The remote computing system 703 is similar to that shown and described in FIGS. 1, and 3 through 6 except that it couples with a remote mounting member 710. The remote mounting member 710, preferably, mounts to a stationary surface, such as a wall, and provides a first communication port 712 for coupling with a communication adapter 722 disposed on the remote computing system 703. Additionally, the remote mounting member 710 includes a first coupling port 714 and a second coupling port 716 for coupling with a first mounting member 718 and second mounting members 720 of the remote computing system 703. Further, the remote mounting member 710 includes a second communication port 724 which couples with a communication adapter 707 connected to the mounting assembly 704.

[0039] The mounting assembly 704 is similar to the mounting assembly shown in FIG. 6, except that the mounting assembly 704 further includes a communicative coupling port 706 and a communication adapter 707. The communication adapter 708, disposed on the housing member 702, engages with the communication port 706 providing a communicative link. The communicative link from the housing member 702 to the remote computing system 703 is completed through the coupling of the communication adapter 707 with the second communication port 724 of the remote mounting member 710. The mounting assembly 704 includes a first mounting port 748, a second mounting

port 750, and a third mounting port 752. These mounting ports allow the mounting assembly 704 to be coupled to a variety of devices such as power tools and the like.

[0040] A table saw system 800 including the laser apparatus 100 mounted on a fence 804 which is connected to a table saw 802, is shown in FIGS. 8 through 10B. Preferably, the laser apparatus 100 provides three laser beams. The laser beams may be used to establish three distance measurements indicated by d1, d2, and d3. These measurements are displayed to the user on the computing system 104. Additionally, the laser beams in communication with the computing system 104 may display a variety of information, such as circular saw blade height, circular saw blade angle, or the like. The table saw 802 further includes a circular saw blade 806, a first adjustment mechanism 808, and a second adjustment mechanism 810. In the present embodiment, the first adjustment mechanism 808 enables a user of the table saw 802 to adjust the angle of the circular saw blade 806 relative to the operational field of the table saw 802. The operational field may be defined as that area of the table saw 802 upon which a work piece may be placed and the circular saw blade 806 may perform a cut upon the work piece. In other embodiments where the laser apparatus 100 is mounted or connected to another power tool or device the operational field may include the area where the work piece is placed and a function is performed upon the work piece. The second adjustment mechanism 810 enables a user to adjust the height which the circular saw blade 806 extends above the surface of the operation field of the table saw 802.

[0041] Referring now to FIGS. 9 and 10A, the laser apparatus 100 coupled to a table saw 802 is shown. The laser apparatus 100 includes the housing 102 coupled with the computing system 104. The housing 102 is mounted to a fence 804 connected to the table saw 802. In FIG. 9, the preferred embodiment is shown. In this embodiment the housing 102 includes a first laser source 106, a second laser source 108, and a third laser source 110 each emitting a laser beam across the operational field of the table saw 802, from the fence 804 to the circular saw blade 806. The laser sources 106, 108, and 110



may emit individual incident laser beams d1, d2, and d3, respectively, which may enable the establishment of the distance from the fence 804 to a circular saw blade 806. For instance, the laser apparatus 100 of this embodiment may send three readings to the computing system 104 where an average may be computed to establish the distance reading. Alternatively, the readings from the individual laser beams may be processed by the computing system 104 in various manners as contemplated by those of ordinary skill in the relevant art. In addition, the computing system 104 may compute the difference between each reading and notify the user if the circular saw blade 806 is warped or bent beyond a predetermined tolerance.

[0042] In FIG. 10A an alternative embodiment is shown. In this embodiment, the single laser source 110 is used to measure the distance d1 from the fence 804 to a circular saw blade 806. It is contemplated that the single laser source may emit one or more laser beams for establishing measurement information. The laser source 110 is communicatively coupled with the computing system 104 which controls the laser source 110 and provides the display of the measurement information established. It is understood in both the embodiments shown in FIGS. 9 and 10A that the computing system 104 may be remotely located from the housing 102 and the laser sources 106, 108, and 110 and may maintain operational control over the laser sources through remote communicative coupling as previously described. It is contemplated that the laser source 110 may be a modular apparatus enabling its removal from the housing of the laser apparatus. Modularity of the laser source 110 may enable easier replacement of damaged or inoperative laser sources and may provide for storage of the laser source 110 in a separate location.

[0043] Referring now to FIGS. 10B and 10C, the laser apparatus 100 is shown enabled to measure the circular saw blade's height measurement. The blade height measurement is the distance between the surface of the table saw and the tallest point of the circular saw blade 806. In FIG. 10B the preferred embodiment is shown. The preferred embodiment

utilizes the laser source 106, 108 and 110 to calculate the height of the saw blade 806. In the preferred embodiment, the three laser sources may emit individual incident laser beams h1, h2, and h3, respectively, which may enable the establishment of the height of the saw blade 806. The three readings, established by the three laser beams, are provided to the computing system 104 where an average may be computed. This average may be used to provide an indication of the blade height. An alternative embodiment is illustrated in FIG. 10C. In this embodiment, the single laser source 110 is used to measure the blade height. As discussed above with respect to blade distance measurement, the single laser source may emit one or more laser beams in order to establish the blade height readings. It is understood in both the embodiments shown in FIGS. 10B and 10C that the computing system 104 may be remotely located from the housing 102 and the laser sources 106, 108, and 110 and may maintain operational control over the laser sources through remote communicative coupling as previously described.

[0044] Referring now to FIGS. 11A and 11B, the table saw assembly 800 is configured with the laser apparatus 100 enabled to measure the beveled angle of the circular saw blade 806. The beveled angle is the angle that the circular saw blade 806 presents at relative to the planar surface of the table 802. In the preferred embodiment of FIG. 11A, the laser apparatus 100 employs the laser source 106, 108, and 110, emitting individual laser beams a1, a2, and a3, respectively, to calculate the bevel angle of the saw blade 806. For instance, the laser apparatus 100 of this embodiment may send three readings to the computing system 104 where an average may be computed. This average may be used to provide an indication of the beveled angle between the circular saw blade 806 and the planar surface of the table 802. Alternatively, the readings from the individual laser beams may be processed by the computing system 104 in various manners as contemplated by those of ordinary skill in the relevant art.

[0045] An alternative embodiment is illustrated in FIG. 11B. In this embodiment, the single laser source 110 is used to measure the beveled angle. As discussed above with respect to blade distance and blade height measurements, the single laser source may emit one or more laser beams in order to establish the blade angle readings. It is contemplated that the single laser source may emit one or more laser beams for establishing measurement information. The laser source 110 is communicatively coupled with the computing system 104 which controls the laser source 110 and provides the display of the beveled angle information established. It is understood in both the embodiments shown in FIGS. 11A and 11B that the computing system 104 may be remotely located from the housing 102 and the laser sources 106, 108, and 110, and may maintain operational control over the laser sources through remote communicative coupling as previously described.

[0046] In a still further embodiment, shown in FIG. 11C, the laser source configuration within the housing 102 of the laser apparatus 100, is changed. In this embodiment, the laser source 106, 108, and 110 are “stacked” or aligned vertically, along a mid-point of the housing 102. The individual laser beams emitted, a1, a2, and a3, provide the beveled angle readings to the computing system 104 for display to a user. It is contemplated that the location of the “stacked” laser sources within the housing 102 may be varied without departing from the scope and spirit of the present invention.

[0047] It is further contemplated that an alternative assembly may be used to measure and indicate the beveled angle of the saw blade 806. This alternative assembly, a bevel indication assembly 1200 coupled with the table saw assembly 800, from FIGS. 8 through 10, is shown in FIGS. 12A and 12B. In FIG. 12A a first exemplary embodiment of the bevel indication assembly 1200 is shown. In this embodiment a laser source 1202 is coupled to an adjustment flange 1204. In the present embodiment, the laser source 1202 is enabled to emit infrared laser beams. Since these laser beams are invisible to the human eye light emitting diodes are linked to the laser beam in order to provide the visual

indication of the travel of the laser beam and contact with a visual marker 1206. In an alternate embodiment the laser source may be enabled to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention. It is further contemplated that the number of laser sources employed and laser beams emitted by the bevel indication assembly may vary without departing from the scope and spirit of the present invention.

[0048] The adjustment flange 1204 rotates in a manner directly proportionate to the circular saw blade 806, which allows the laser source 1202 to accurately indicate the beveled angle when rigidly mounted to the adjustment flange 1204. The laser source 1202 in this embodiment indicates the beveled angle by emitting a laser beam 1208 onto a visual marker 1206 mounted to the table saw assembly 200. In the preferred embodiment, the visual marker 1206 is coupled with the cabinet of the table saw assembly 200. The visual marker 1206 is equipped with a scale that may read from 0 (zero) degrees to 45 (forty-five) degrees. While it is contemplated that the scale may read from 0 degrees to 45 degrees in the present embodiment, the scale may display any range of degrees without departing from the scope and spirit of the present invention. The user may obtain a read-out from the bevel indication assembly 1200 by first rotating the circular saw blade 806. In order to rotate the circular saw blade 806, the user may rotate a hand-wheel 810 that is coupled to the adjustment flange 1204. The adjustment flange 1204 may be coupled to the circular saw blade 806 and also the laser source 1202. Therefore, when the adjustment flange 1204 rotates, the laser source 1202 may also rotate and emit the laser beam 1208 onto the visual marker 1206. Where the laser beam 1208 is emitted on the visual marker 1206 may be dependent on the angular position of the adjustment flange 1204. Hence, the visual marker 1206 may be positioned on the table saw system 800 so that the laser beam 1208 highlights the angle that corresponds to the actual beveled angle of the circular saw blade 806.

[0049] It is contemplated that the visual marker 1206 may be equipped with two scales positioned side by side for beveling in either direction. Each scale may read from zero degrees to forty five degrees. It is further contemplated that, to make reading the scale more convenient, the scale may be color-coded which would allow users to associate a color with each direction of tilt. For instance, the scale for right tilt operation may be blue while the scale for left tilt operation may be green. It is still further contemplated that the visual marker 1206 may be angularly configured for mounting with the table saw system 800. For example, the visual marker 1206 may form an arc. The arc may increase the precision of the readings obtained from contact of the laser beam with the visual marker 1206.

[0050] Alternative configurations of the visual marker 1206 may be enabled, such as a triangular configuration with two separate scales disposed on two sides of the triangle. One side provides zero to forty-five degree readings for left tilt operation while the other accomplishes the same for right tilt operation. The triangular visual marker may be coupled with the table saw system 800 in a manner which allows a user to adjust the triangle to show the side with the appropriate scale for the direction of tilt of the saw blade. It is also contemplated that the bevel indication assembly, including the triangular visual marker, may automatically adjust the display side of the triangular visual marker to coincide with the direction of tilt intended for the saw blade. Further alternative configurations, as contemplated by those of ordinary skill in the relevant art, may be employed without departing from the scope and spirit of the present invention.

[0051] In FIG. 12B a second exemplary embodiment of the bevel indication assembly 1200, is shown. In this embodiment, the bevel indication assembly 1200 operates in the same manner as the first exemplary embodiment described in the previous paragraph. However, a visual marker 1210 of the second exemplary embodiment may be located at a remote position from the table saw assembly 800. In this embodiment the visual marker 1210 takes the form of a rollout mat. The mat may be positioned on the floor of the

user's work area so that the laser source 1202 emits the laser beam on the angle that corresponds to the actual beveled angle,  $\alpha_1$ . By providing a means to position the visual marker 1210 on the floor, a much larger scale may be employed without restricting the users workspace. A larger scale may be easier to read from a variety of positions around the table saw assembly 800 and when the table saw assembly 800 is engaging larger work-pieces which may hang over the top of the table obstructing the view of the visual marker if it was coupled directly with the table saw assembly 800, as described above.

[0052] The laser source 1202 may be a modular unit enabling its removal from the adjustment flange 1204. This modularity may enable the adjustment flange 1204 to be retro-fitted with various laser source assemblies. The retro-fitting capability may increase the ease of use of the bevel indication assembly and the useful life span of the laser source employed. For example, one laser source, which establishes a point of light on the visual marker, may be replaced with a laser source which establishes a light line on the visual marker. The light line may increase the ease with which an operator of the table saw assembly 800 may identify the beveled angle of the saw blade 806. Additionally, the laser source may be removed and stored in a location remote from the table saw assembly 800. Thus, damage to the laser source may be decreased.

[0053] Referring now to FIGS. 13 a laser light indicia and reading assembly 1300 is shown. In the current embodiment, the laser light indicia and reading assembly 1300 comprises a housing 1302 which includes a laser source 1304 in communication with a computing system 1306. The housing 1302 is coupled with a mounting member 1308. A communication adapter 1310 communicatively couples the computing system 1306 with the laser source 1304 disposed within the housing 1302 through a cable 1311. The type of cable employed in the present embodiment is a standard serial cable. However, it is contemplated that a variety of connection mechanisms may be employed, such as wireless, infrared, or the like. The computing system 1306 is similar to the computing system 104 in that it provides a display screen 1312, a first selector 1314, a second

selector 1316, and a third selector 1318. Additionally, the computing system 1306 may further include a keypad 1320, as shown in the current embodiment. The keypad 1320 may enable increased functionality of the computing system, such as increased control over the laser source.

[0054] In FIG. 14 a laser light indicia and reading assembly 1400 is shown. In the present embodiment, the laser light indicia and reading assembly 1400 comprises a housing 1402 which includes a laser source 1404, a computing system 1406, and a mounting assembly 1408. The housing 1402 is coupled with a mounting member 1412 for coupling with the mounting assembly 1408. The mounting assembly 1408 further includes a communication adapter 1410 which couples with the laser source 1404 through the housing 1402. Preferably, the communication adapter 1410 is coupled with a cable 1411 which connects to the mounting assembly 1408. It is understood that the configuration of the communication adapter 1410 and type of cable 1411 employed may vary as contemplated by one of ordinary skill in the art. Through the serial cable 1411 the communication adapter 1410 is further communicatively coupled with the communication port 1414.

[0055] In the present embodiment, the communication port 1414 is designed to couple with the computing system 1406 when it is mounted to the mounting assembly 1408. Further, a first coupling port 1416 and a second coupling port 1418 are disposed on the mounting assembly 1408 and further engage with the computing system 1406 when the computing system 1406 is mounted to the mounting assembly 1408. The computing system 1406 is similar to the computing system 104 shown and described previously, except that the computing system 1406 includes an indicator 1420. The indicator 1420 is a light emitting diode (LED) which provides indication to the user of the system 1400 when the computing system 1406 is properly mounted and engaged with the mounting assembly 1408. It is contemplated that the computing system 1406 may not include

indicator 1406. However, a variety of configurations may be employed for indicator 1420 without departing from the scope and spirit of the present invention.

[0056] A leveling device 1422 is disposed within mounting assembly 1408. As shown and described previously in FIGS. 6 and 7 the leveling assembly ensures that the laser light indicia and reading assembly 1400 is level with the device to which it is connected. A first mounting port 1426 and a second mounting port 1428 are employed to connect the mounting assembly 1408 with the desired device. In the present embodiment the mounting ports allow for screws to be inserted and fastened to the device and the mounting assembly 1408. However, it is contemplated that a variety of fastening devices and configurations may be employed.

[0057] The mounting assembly 1408 further comprises a laser source coupling port 1424. The laser source coupling port 1424 is designed to receive the mounting member 1412 which is coupled to the housing 1402 disposed with the laser source 1404. The mounting member 1412 includes a release mechanism comprised of a button 1430 disposed on the housing 1402, and a latch 1432. The button 1430 is a depression button, operably engaged with the latch 1432, which the user may depress in order to activate the latch 1432. The latch 1432 is a compression latch which retracts back into the mounting member 1412 when the button 1430 is depressed. The latch 1432 is extended away from the mounting member 1412 and engages the inner surface of the laser source coupling point 1424 to affix the housing 1402 to the mounting assembly 1408.

[0058] In the preferred embodiment, the laser source for both FIGS. 13 and 14 is enabled as a standard single laser beam producing laser source. Alternatively, the laser source in both FIGS. 13 and 14 may be enabled as a scanning module. A known scanning module 1500 is shown in FIG. 15A, 15B, and 15C. The scanning module 1500 comprises a laser source 1502 with a spherical lens 1504 disposed in a housing 1503. The housing 1503 includes an aperture 1505 through which a laser beam, emitted from the laser source



1502 through the spherical lens 1504, passes. The laser beam travels through a cylindrical lens 1506 and strikes a multifaceted polygon deflector 1510. The multifaceted polygon deflector 1510 deflects the incident laser beam emitted by the laser source through the cylindrical lens 1508 and out to a surface 1512. The surface 1512 is a nominal plane and the incident laser beam is provided a first focus 1514. As indicated by the arrows the scanning module 1500 moves the focused laser beam along the surface 1512. The scanning module may further include two light emitting diode assemblies 1516 and 1518. These assemblies emit a visible light that tracks the position of the laser beam providing an indicator for a user of the scanning module.

[0059] The laser beam from the scanning module 1500 may appear as a continuous line defined by the angle of incidence with which the laser beam strikes the multifaceted polygon deflector 1510. As such, the light emitting diodes would provide the visual indication of the defined area to the user.

[0060] The scanning module 1500 receives the reflected laser beams through the cylindrical lens 1508. The reflected laser beams may travel directly to the photodetector 1520 or the laser beams may travel to the multifaceted polygon deflector. The laser beams which strike the multifaceted polygon deflector are deflected to a collecting mirror 1522 where they are reflected to the photodetector 1520. In this manner the scanning module 1500 is enabled to read a surface it is scanning.

[0061] It is contemplated that the laser source(s) employed in the laser light indicia and reading assembly and the laser apparatus may include a dithering assembly. A typical dithering assembly 1600, known in the art, is shown in FIG. 16. The dithering assembly 1600 includes a laser source 1602 and a mirror 1604 disposed within a housing 1606 and may be employed to establish a laser beam which presents as a continuous line upon a surface. Further, it is known that dithering assemblies may comprise a pair of magnets and a pair of magnetic coils. As shown in FIG. 17 a mirror 1702 is coupled to a base

1704 which is connected to a flexible support arm 1706 that is connected to a support member 1708. A drive coil 1710 is positioned on one side of the flexible support arm 1706 and a feedback coil 1712 is positioned on the opposite side of the flexible support arm 1706. A drive magnet 1714 is connected to the base 1704 and proximally located to the drive coil 1710 while a feedback magnet 1716 is connected to the base 1704 and proximally located to the feedback coil 1712. A drive current (e.g., an oscillating drive current) is run through the drive coil 1710 and causes the mirror 1702 to rotate. The rotation imparted to the mirror 1702 causes a change in the angle of incidence of the laser beam striking the mirror, and thus imparts a change in the angle of reflection imparted to the incident laser beam. As a result, the reflected laser beam appears as a continuous line defined by the rotational range of the mirror 1702.

[0062] Additionally, dithering assemblies which control the range of rotation of the mirror are known. FIG. 18 shows one such assembly where a mirror 1802 is connected to a base 1804, which is connected to a flexible support arm 1806 that is connected to a support member 1808 coupled to a surface 1810. A drive coil 1812 is coupled to the support member 1808 in proximal relation to a drive magnet 1814 which is coupled with the base 1804. A first travel stop 1816 and a second travel stop 1818 are disposed in a desired location relative to the mirror 1802 to provide a limited range of rotation by the mirror 1802.

[0063] Alternative methods for controlling the range of rotation of the mirror in a dithering assembly may include the use of pads, as shown in FIG. 19. The mirror 1902 is connected to a base 1904, which is connected to a flexible support arm 1906 that is connected to a support member 1908 coupled to a surface 1910. A drive coil 1912 is coupled to the support member 1908 in proximal relation to a drive magnet 1914 which is connected to the base 1904. A feedback coil 1916 is coupled to the support member 1908 in proximal relation to a feedback magnet 1918, which is connected to the base 1904. A first pad 1920 is coupled with the drive magnet 1914, and a second pad 1922 is

coupled with the feedback magnet 1918. The pads, which impact with the drive and feedback coils, limit the rotation range of motion of the mirror 1902.

[0064] In many dithering assemblies the effects of feedback between the drive coil/magnet and the feedback coil/magnet may have harmful effects, such as increased noise and unstable rotational amplitude production. A feedback sensor, such as a Hall sensor, may be employed to monitor electrical potential in a dithering assembly and trigger a switching of the polarity of the drive current in the drive coil at the appropriate time in relation to the position of the mirror. This switching of polarities reverses the drive force being exerted on the drive magnet and the mirror.

[0065] Referring now to FIG. 20, a table saw system 2000 including a laser light indicia and reading assembly 2002, is shown. The laser light indicia and reading assembly 2002 is similar to the laser light indicia and reading assembly 1300 and 1400 shown in FIGS. 13 and 14, and includes a computing system 2003 similar to that shown in FIGS. 13 and 14. In the current embodiment, the table saw system 200 further includes a table 2004, a fence 2006, and a circular saw blade 2008. Additionally, a first adjustment mechanism 2010 and a second adjustment mechanism 2012 are included in the table saw system 200 and operably engage with the circular saw blade 2008 to adjust blade angle and blade height relative to the operational field of the table saw system 2000, as described previously in FIG. 8.

[0066] In this embodiment the laser light indicia and reading assembly 2002 establishes a continuous laser beam line 2014. The laser beam line 2014 is laid down across the operational field of the table saw system 2000 and provides a cut line for a user of the system. It is contemplated that the laser light indicia and reading assembly 2002 will establish a laser beam line that tracks the position of the circular saw blade 2008. For example, if the user adjusts the angle of the circular saw blade 2008 relative to the operational field of the table saw system 2000, the laser light indicia and reading

assembly 2002 will monitor that change and establish a laser beam line that tracks the position of the circular saw blade 2008.

[0067] In an alternate embodiment the laser beam line 2014 may be established using optically activated indicators that are integrated with the table 2004 in positions proximal to the circular saw blade 2008. For example, the table 2004 may be integrated with sensors which respond by illuminating upon being struck by light from the laser light indicia and reading assembly 2002. Alternately, optically activated cables may be integrated into the table saw to provide a laser line. Regardless of the type of optically activated indicators, their positioning relative to the circular saw blade 2008 and the lines of cut that may be established through use of the adjustment mechanisms provides a user an easily ascertained path to guide the cutting of the work piece by.

[0068] Referring now to FIG. 21, a table saw system 2100 is shown. The table saw system 2100 comprises a laser light indicia and reading assembly 2102, similar to the laser light indicia and reading assembly previously described in FIGS. 13, 14, and 20, a table 2104, a fence 2106, and a circular saw blade 2108. The laser light indicia and reading assembly 2102 is coupled to a computing system 2103, the computing system 2103 being similar to that previously described in FIGS. 13, 14, and 20. Additionally, a work piece 2112 is located within the operation field of the table saw system 2100 and is being guided by the fence 2106 and an angular adjustment mechanism 2110. The angular adjustment mechanism 2110 may position the work piece 2112 in a desired angular setting and then guide the work piece 2112 through the circular saw blade 2108 at the set angle. In the current embodiment the laser light indicia and reading assembly establishes a laser beam light line 2114 across the work piece 2112. This laser beam light line 2114 may be used by the user as the cut line and followed throughout the cut.

[0069] It is contemplated that the laser light indicia and reading assemblies 2002 and 2102 of FIGS. 20 and 21 may include an indexing and truing functionality. An example

of the truing of a work piece may include a user attempting to make a forty five degree angled cut on the work piece. The user may enter this information into the computing system in communication with the laser light indicia and reading assembly and when the work piece is set into the operational field of the table saw system, the laser light indicia and reading assembly may emit a laser beam which identifies the angle that the work piece is set at in relation to the circular saw blade. An example of the indexing of a work piece may include a user attempting to make a notch cut into a work piece that does not run the length or width of the work piece. When the work piece is set into the operational field of the table saw system, the laser light indicia and reading assembly may emit a laser beam which determines the position of the leading edge of the work piece. As the work piece is passed across the circular saw blade, the laser beam enables the laser light indicia and reading assembly to monitor the rate of travel imparted to the work piece and the overall distance of travel across the circular saw by the work piece. In this manner the laser light indicia and reading assembly may communicate to the computing system when the desired length of cut has been accomplished, and have that information passed on the user.

[0070] The user may be notified as to the truing and indexing information through the computing system, as previously discussed. Alternatively, the laser light indicia and reading assembly may be provided with an indicator to communicate to the user that the desired specifications have been accomplished. For example, a red light emitting diode may be coupled to the housing of the laser light indicia and reading assembly for indicating to the user that the desired function has not been accomplished. A green light emitting diode, coupled to the housing of the laser light indicia and reading assembly, may indicate to the user that the desired function has been accomplished and it is time to proceed or remove the work piece from the field of operation. Other indication systems as contemplated by one of ordinary skill in the art may be employed without departing from the scope and spirit of the present invention.

[0071] Referring now to FIGS. 22A, 22B, 24A, and 24B, a table saw assembly 2200, similar in every respect to the table saw assembly 2000 and 2100, includes a laser light indicia and reading assembly 2202 operationally coupled with a computing system 2204. In FIGS. 22A and 22B the computing system 2204 is shown coupled with a first exemplary docking station 2208. The first exemplary docking station 2208 is coupled with a mounting assembly 2210 which is remotely located from the laser light indicia and reading assembly 2202. Alternatively, in FIGS. 24A and 24B, the computing system 2204 is shown disposed in a second exemplary docking station 2212 which is coupled with the laser light indicia and reading assembly 2202. Either embodiment may be preferred, however, it is contemplated that alternative configurations may be employed without departing from the scope and spirit of the present invention.

[0072] The laser light indicia and reading assembly 2202 coupled with the computing system 2204 may enable the measurement of the blade height, distance from a fence to the saw blade, and the beveled angle of the saw blade. The laser light indicia and reading assembly 2202 emits a laser beam 2214 from a laser source 2206 which operationally engages with the circular saw blade to measure its height above the tabletop, distance from a fence, or beveled angle. The established measurement is then displayed on a display screen 2216, of the computing system 2204. The computing system 2204 may further enable the user with the ability to adjust the blade height, distance from fence, and beveled angle of the saw blade. The laser light indicia and reading assembly 2202 is useful because the computing system 2204, including the display screen 2216, may be located above the table saw assembly 2200 as opposed to on one of its walls. This position may increase the ease of viewing from multiple positions around the table saw.

[0073] Referring now to FIGS. 23 and 24C, a table saw assembly 2300 similar in every respect to the table saw assembly 2200 except that table saw assembly 2300 includes a first laser light indicia and reading assembly 2302 and a second laser light indicia and reading assembly 2304. In the preferred embodiment, the first laser light indicia and

reading assembly 2302 is coupled with a fence 2320. It is understood that this coupling may enable movement capabilities and removal of the first laser light indicia and reading assembly 2302, relative to the fence 2320. Further, the second laser light indicia and reading assembly 2304 is coupled with a table 2324 via a mounting assembly 2322. In the current embodiment, the mounting assembly 2322 is coupled with the table 2324 proximal to the axis of a saw blade 2326. The second laser light indicia and reading assembly 2304 may be adjusted relative to or removed from the mounting assembly 2322. The first laser light indicia and reading assembly 2302 includes a first laser source 2306 which emits a first laser beam 2310. The second laser light indicia and reading assembly 2304 includes a second laser source 2308 which emits a second laser beam 2312. In the preferred embodiment, the first and second laser beams operationally contact the saw blade 2326 to establish the desired measurements, such as blade height, distance from fence, and beveled angle of the saw blade 2326.

[0074] Mechanically coupled with the mounting assembly 2322 is a docking station 2318 which may engage a computing system 2314, the computing system 2314 including a display 2316. The computing system 2314 is similar to those shown and described in previous FIGS. 1 through 22. In the preferred embodiment, the computing system 2314 is coupled with the first and second laser light indicia and reading assemblies. The computing system 2314 may establish the communicative coupling with the first and second laser light indicia and reading assemblies through implementation of various communication technologies, such as hardwire, blue-tooth, fiber optics, radio frequency, and the like. It is contemplated that the first and second laser light indicia and reading assemblies may be communicatively coupled to one another by similar communication technologies that establish their link with the computing system 2314.

[0075] It is contemplated that the computing system 2314 may be removed from the docking station 2318 and that the docking station 2318 may be adjustably or removably coupled with the mounting assembly 2322. In the alternative embodiment, shown in

FIGS. 24C, the docking station 2318 is coupled with the first laser light indicia and reading assembly 2302. It is further contemplated that the docking station 2318 may be coupled to various other structures remote from the table saw assembly 2300.

[0076] It is understood that the laser light indicia and reading assemblies may be modular apparatus enabled to be removed from a mounting assembly or power tool as the case may be. Further, the number and configuration of laser light indicia and reading assemblies may vary without departing from the scope and spirit of the present invention. For example, three or more laser light indicia and reading assemblies may operationally engage with a saw blade of a table saw assembly. Still further, the mounting and positioning of the laser light indicia and reading assemblies, as shown in FIGS. 13 through 24 and as may be shown throughout the present application, may be optimally configured in various manners to enable the full functionality of the table saw assembly to which they may be coupled. For example, the second laser light indicia and reading assembly 2304, shown in FIG. 23, may be enabled through the mounting assembly 2322 to retract from the operational position shown in FIG. 23 to a secondary position which removes it from operational contact with the planar surface of the table 2324.

[0077] A flowchart illustrating functional steps which may be accomplished using the laser apparatus of FIGS. 1 through 12 and the laser light indicia and reading assembly of FIGS. 13 through 24, is shown in FIG. 25. The first step 2510 involves the setting of the machine. This involves mounting the laser apparatus to the power tool being utilized. As discussed previously, the laser apparatus may be directly mounted to a power tool or mounted to a separate mounting assembly which is connected to the power tool. Once the laser apparatus has been properly set then in step 2520 the laser apparatus must be trued in order to provide accurate results. This may be accomplished by checking the leveling mechanism as described previously, if such a mounting assembly is being employed or using the laser beams to determine the correct alignment. If the laser apparatus determines that the mounting is untrue it notifies the user. Once the laser



apparatus determines it is truly aligned then in step 2530 the work piece is set. Once the laser apparatus determines that the work piece has been set then in step 2540 it determines if the setting of the work piece is true. Once the work piece is trued the user begins operation of the power tool in step 2550. When it is determined that the machining of the work piece is completed in step 2560 operation of the power tool is halted.

[0078] It is contemplated that an optically reflective material may be disposed upon a surface that is struck by the laser beam emitted from the laser apparatus or the laser light indicia and reading assembly. In this manner when the laser beams are emitted they will strike the optically reflective material and be reflected. In one embodiment the reflected laser beams may be received by an optical detector disposed within the housing of the laser apparatus or the laser light indicia and reading assembly. The optical detector may be in communication with the computing system and the computing system may process the laser beam information to determine measurements and other setting information. In alternate embodiments the reflected laser beam may be received by one or several optical detector(s) remotely located with respect to the laser apparatus or the laser light indicia and reading assembly, but in communication with the computing system. As stated above the optical detector will relay the information gathered from the laser beam to the computing system where it may be processed and displayed to a user as measurement of setting information. For example, an optically reflective material may be circumferentially disposed about a circular saw blade of a table saw. The table saw may be disposed with a fence that has a laser apparatus (as described in FIG. 1) mounted upon it. The laser apparatus may emit one or more incident laser beams which strike the optically reflective material on the circular saw blade and, if the circular saw blade is perpendicular to the incident laser beams, are reflected back towards the laser apparatus. The laser apparatus may be disposed with one or more optical detectors to receive the reflected laser beam(s) and communicate the information gathered to the computing

system for processing and display to a user. The type and configuration of the optically reflective material may vary as contemplated by one of ordinary skill in the art.

[0079] It is further contemplated that the laser apparatus or the laser light indicia and reading assembly may establish a communicative link with their respective computing systems through a communication system disposed within the device, to which the laser apparatus or the laser light indicia and reading assembly are mounted, itself. In this manner a mounting assembly as shown in FIGS. 6, 7, and 14 would not be necessary and the laser apparatus or the laser light indicia and reading assembly may be directly mounted to the device. Additionally, the laser apparatus or the laser light indicia and reading assembly may be enabled to accept power from the device to which they are mounted, thus, reducing the need to have a separate power source or power source connection. For example, a fence mounted to a table saw system may be disposed to connect with the laser apparatus or the laser light indicia and reading assembly. The fence may include a communication port, as shown and described on the mounting assemblies of FIGS. 7 and 14, which couples with a communication adapter disposed on the housing of the laser apparatus or the laser light indicia and reading assembly. The fence may further include a communication adapter which may be coupled with the computing system, thereby enabling the computing system to be in communication with the laser apparatus or the laser light indicia and reading assembly. Further, the power source for the table saw system may include an outlet on the fence which may be engaged by the laser apparatus or the laser light indicia and reading assembly to provide power to either system.

[0080] Heat build-up within the laser apparatus or the laser light indicia and reading assembly is an important concern. Overheating may result in malfunctioning of the laser source(s) within the housing and cause damage to the laser source or housing necessitating expensive repair and lost time. In one embodiment of the present invention the laser source may be a low power and low intensity laser source to minimize the heat

build up with the housing. Such an embodiment is suitable for situations where the use of the laser apparatus and the laser light indicia and reading assembly is sporadic and limited. However, in a situation where the laser apparatus or the laser light indicia and reading assembly are in constant use over prolonged periods of time even a low power and intensity laser source may experience significant heat build up which may damage the system.

[0081] To handle a situation where the heat build up is significant, the laser apparatus and the laser light indicia and reading assembly may include a cooling system. In one embodiment, the housing of either system may include vents to allow heat to escape and cooler air to be drawn into the housing to help cool the laser sources. In an alternate embodiment, the cooling system may be comprised of a fan assembly mounted within the housing to blow air through the housing and over the laser source(s). The housing may include a vent located at an end opposite the fan to allow the blown air and heat to escape. In a third embodiment a cooling system may comprise an inert coolant being run through the housing of the laser apparatus or the laser light indicia and reading assembly. The coolant system may include a tank of the inert coolant connected to the housing through tubing and then an exhaust system connected to the housing for removing and disposing of the inert coolant after it has run through the housing. It is contemplated that a coolant system may be disposed within a device to which the laser apparatus and the laser light indicia and reading assembly are connected. The inert coolant may be presented and exhausted through the mounting connection between the device and the laser apparatus or the laser light indicia and reading assembly. For example, the laser apparatus of FIG. 1, may include connection portals in the mounting members. When the mounting members are secured to a fence, such as shown in FIGS. 8 through 10, tubing, which is connected to a tank of the inert coolant, may be connected to one of the mounting members. The inert coolant may be pumped into the housing through the mounting member and then exhausted through the other mounting member. It is contemplated that a variety of coolant systems, as may be contemplated by one of

ordinary skill in the art, may be employed without departing from the scope and spirit of the present invention.

[0082] Referring now to FIG. 26 a table saw system 2600 including a laser apparatus 2602, is shown. The table saw system 2600 further includes a work surface 2616, a fence 2618, a circular saw blade 2620, and an adjustment mechanism 2622. The laser apparatus 2602 is similar to the laser apparatus of FIG. 1 with a housing 2604 and a computing system 2614. However, the laser apparatus 2602 includes four laser sources 2606, 2608, 2610, and 2612 disposed within the housing 2604 and each laser source includes a dithering assembly. In the present embodiment, the laser sources establish multiple laser beam lines across the operational field of the table saw system 2600. The laser beams provide information on distance of the fence 2618 from the circular saw blade 2620, the angle of the circular saw blade 2620 relative to the work surface 2616, and have the ability to sense when a work piece has entered the operational field of the table saw system 2600. It is understood that the laser apparatus 2602 may gather a variety of other information as discussed in FIGS. 1 through 12, without departing from the scope and spirit of the present invention.

[0083] Referring now to FIG. 27, a table saw system 2700 including a first laser light indicia and reading assembly 2702 and a second laser light indicia and reading assembly 2704, is shown. Both the first and the second laser light indicia and reading assemblies 2702 and 2704 are coupled to a computing system 2703. The computing system controls the functionality of both laser light indicia and reading assemblies. Alternatively, each laser light indicia and reading assembly may be coupled with a separate computing system. The table saw system 2700 further includes a work surface 2706, a fence 2708, a circular saw blade 2710, and an angle adjustment mechanism 2712. The angle adjustment mechanism is similar to that discussed in FIG. 21. In the present embodiment, the first and second laser light indicia and reading assemblies are similar to the laser light indicia and reading assembly shown and described in FIG. 13, except that

each of the housings is disposed with a plurality of laser sources. The plurality of laser sources may be enabled as scanning modules or include dithering assemblies to produce a laser beam grid 2716 upon a work piece 2714. Alternately, the laser beam grid 2716 may be established upon a work surface 2706 of the table saw system 2700. Using the first and second laser light indicia and reading assemblies a user of the table saw system 2700 is enabled to establish multiple cut lines and grid points by intersecting the laser beam lines produced. The exact location of the grid points may be determined by the user and entered into the computing system which controls the laser light indicia and reading assemblies. It is contemplated that a single computing system may be enabled to control both laser light indicia and reading assemblies or that a separate and independent computing system may be used to control each laser light indicia and reading assembly. In an alternate embodiment the laser light indicia and reading assemblies may be disposed with a single laser source as described in FIG. 13.

[0084] Referring now to FIGS. 28A through 29B, a table saw assembly 2800 similar to the table saw assembly 800 in every respect except that the table saw assembly 2800 further includes a first laser light indicia and reading assembly 2810 and a second laser light indicia and reading assembly 2820. The first laser light indicia and reading assembly 2810 is coupled with a fence 2860, which is coupled with a table 2870. It is contemplated that the first laser light indicia and reading assembly 2810 may be adjustably coupled with the fence 2860 and further that the first laser light indicia and reading assembly may be removed from the fence 2860. The second laser light indicia and reading assembly 2820 is coupled, via a mounting assembly 2880, with the table 2870. It is contemplated that the mounting assembly 2880 may be various assemblies, such as a riving knife assembly, blade guard assembly, and the like. Further, the second laser light indicia and reading assembly 2820 may be adjustably coupled with the mounting assembly 2880 or removable from the mounting assembly 2880. In alternative embodiments, the second laser light indicia and reading assembly 2820 may include a

mounting apparatus which enables coupling, preferably adjustable and/or removable, with the table saw assembly 2800.

[0085] In the preferred embodiment, the first and second laser light indicia and reading assembly 2810 and 2820 are communicatively coupled with a computing system 2850 which is similar to the computing system 104, described previously. It is understood that the first and second laser light indicia and reading assemblies may be operationally and/or communicatively coupled with various devices, such as a user interface discussed below. FIGS. 28A and 28B illustrate the multiple laser light indicia and reading assemblies measuring blade height,  $h_1$ , of the saw blade 2805, while FIGS. 29A and 29B illustrate the invention providing a reading of the beveled angle,  $a_1$ , of the saw blade 2805. The first laser light indicia and reading assembly 2810 employs a first laser source 2830 and the second laser light indicia and reading assembly 2820 employs a second laser source 2840. In the preferred operational embodiment shown in the current FIGS. 28 through 29, the first and second laser sources 2830 and 2840 emit laser beams which establish a grid pattern of coverage upon the table 2870 of the table saw assembly 2800. The grid pattern established may enable the table saw assembly 2800 to provide increased accuracy in the readings established. The first and second laser sources may be similar to the laser sources described previously, in that the emitted laser beams may be invisible to the human eye. Alternatively, the first and second laser sources may be enabled with assemblies, such as light emitting diode assemblies, which may visibly establish the pattern of the emitted laser beams upon the table 2870.

[0086] A rotating laser apparatus 3000 including a first housing member 3002, a second housing member 3004, and a computing system 3006 is shown in FIGS. 30 through 37. The first housing member 3002 includes a first laser source 3014, a second laser source 3016, a communication port 3018, a first coupling port 3020, a second coupling port 3022, and a grip 3024. The first housing member may include a mounting member, a latch, and a release mechanism as described previously in FIG. 1. The second housing

member 3004 includes a third laser source 3026, a fourth laser source 3028, and a grip 3030. The second housing member 3004 may also include a mounting member, a latch, and a release mechanism as described previously in FIG. 1. The communication port 3018 provides communicative linkage to all four laser sources disposed within the first and the second housing members.

[0087] In the current embodiment, the computing system 3006 is coupled with the first housing member 3002. The computing system 3006 is similar to the computing system 104 described previously. The computing system includes a first selector 3032, a second selector 3034, and a third selector 3036. Further, a display screen 3038 provides an interactive medium for a user who is operating the rotating laser apparatus 3000. Additionally, the computing system 3006 includes a communication adapter 3038 for coupling with the communication port 3018 disposed on the first housing member 3002. The computing system also includes a first mounting member 3040 and a second mounting member 3042 for engaging with the first and second coupling ports 3020 and 3022 disposed on the first housing member 3002. A first button 3044 and a second button 3046 operably engage with the first and second mounting members to perform a latch and release function enabling a user to secure the computing system 3006 to the first housing member 3002 and remove the computing system 3006 from the first housing member 3002. An indicator 3048 is included on the computing system 3006 to provide a user feedback on whether the computing system 3006 is in communication with the four laser sources.

[0088] The two housing members 3002 and 3004 are coupled by a rotation mechanism 3008. The rotation mechanism 3008 comprises a joint 3010 coupled with an angle measurement device 3012. The angle measurement device 3012 includes teeth along the outer edge, away from the joint 3010. The teeth of the angle measurement device are engaged by a ratchet arm 3050 coupled on one end with a coiled compression spring mechanism 3052 and an activation mechanism 3054 on the other end. In the present

embodiment, the ratchet arm 3050 and the coiled compression spring mechanism 3052 are disposed on the inside of the second housing member 3004 in a position proximal to the angle measurement device 3012. The activation mechanism 3054 extends through the second housing member 3004 allowing the user to depress an activation push button and adjust the angle of the second housing member 3004 relative to the first housing member 3002.

[0089] Preferably, joint 3010 is a hinge that allows the first and second housing members to be rotated along two axes, as shown in FIGS. 31 through 35. It is understood that the joint 3010 may be a variety of devices which enable such functionality as may be contemplated by one of ordinary skill in the art. Further, the angle measurement device 3012 indicates to a user of the rotating laser apparatus 3000 the degree that the first housing member 3002 is relative to the second housing member 3004. The position of the angle measurement device 3012 is fixed relative to the first housing member 3002. The fixed positioning of the angle measurement device 3012 may be accomplished by coupling the angle measurement device 3012 to the first housing member 3002, the joint 3010, or other methods as may be contemplated by one of ordinary skill in the art. The second housing member 3004 is allowed to slide freely over the angle measurement device 3012 as it is rotated relative to the first housing member 3002.

[0090] Alternatively, the rotation mechanism may be comprised of a variety of systems, such as a hydraulic system, compression system, or the like. Further, the user engagement device (i.e., the activation push button of the exemplary embodiment) may be other mechanisms as contemplated by one of ordinary skill in the art. Additionally, the rotation mechanism may be engaged directly by the user, as described above, or the rotation mechanism may be in communication with the computing system and the user may enter the desired angle and the rotation mechanism may set the rotating laser apparatus 3000 in the desired position.



[0091] In the present embodiment, each of the two housing members include two laser sources. The first housing member 3002 includes a first laser source 3014 and a second laser source 3016. The second housing member 3004 includes a third laser source 3026 and a fourth laser source 3028. As shown in FIG. 35, the laser sources 3014, 3016, 3026, and 3028 may form a virtual grid allowing the user to specify a particular location for the execution of a function. Alternatively, the rotating laser apparatus 3000 may include a fewer or greater number of laser sources disposed within each of the housing members.

[0092] As discussed above, the computing system 3006 is similar to the computing system described previously in FIGS. 1 through 29. In the present embodiment, the computing system 3006 is in communication with the laser sources 3014, 3016, 3026, and 3028, and mounts upon the first housing member 3002. It is contemplated that the coupling of the computing system 3006 may occur upon the second housing member 3004. Exemplary interactive displays, readable on the computing system 2405, are shown in FIGS. 31, 36 and 37. The interactive displays may provide the user a display of the status of the laser source(s), the angle between the first and second housing members, the type of pattern to established, and gather information from the laser beams. Further, when the computing system 3006 is in communication with the rotation mechanism 3008 an interactive display on the computing system 3006 may allow the user to enter the desired angle and have the rotation mechanism set to that angle.

[0093] Referring now to FIG. 38, a flowchart illustrating the functional steps achieved using the interactive display of the computing system 3006 of the rotating laser apparatus 3000, is shown. In step 3810 the interactive display 3008 of the computing system 3006 asks the user to specify if an angle is required for the current assignment. The angle referred to is the angle that the first housing member 3002 is at relative to the second housing member 3004. If the user responds in the affirmative to this query then the user is asked to specify the angle required in step 3820. After the angle has been specified or if no angle is required for the current assignment, as directed by the user inputting the

information through the interactive display 3008 of the computing system 3006, then in step 3830 the laser pattern is established.

[0094] Establishing the laser pattern occurs by the user being asked on the interactive display to specify the laser pattern required. In step 3840 the user is asked if the laser pattern is a straight laser pattern. If the user responds affirmatively, indicating that a straight laser pattern is to be established, then in step 3860 the laser signal is sent to establish the straight pattern. If in step 3840 a user indicates that a straight pattern is not desired then the user is asked, in step 3850, if a cross pattern is to be established. If the user responds to this query by indicating that a cross pattern is not to be established then the computing system 3006 returns to step 3830 and the interactive display prompts the user that the laser pattern setting must be established. It is contemplated that the computing system 3006, through the interactive display 3008, may allow for the user to manually enter a laser pattern to be established. If the user responds to the query of step 3850 in the affirmative, indicating that a cross pattern is to be established, then in step 3860 the laser signal is sent to establish the cross pattern.

[0095] Referring now to FIG. 39, a laser apparatus 3900, is shown. In the current embodiment, the laser apparatus 3900 comprises a housing 3902 and a laser source 3904 coupled with the housing 3902. The housing 3902 further includes a first optical splitter 3906, a second optical splitter 3908, and a third optical splitter 3910. Further, the housing includes a first optical reflector 3912. Each of the optical splitters and the optical reflector is disposed within the housing 3902 in proximal location to a first emitter 3914, a second emitter 3916, a third emitter 3918, and a fourth emitter 3920, respectively.

[0096] The optical splitters function to split an incident laser beam received into two or more refracted laser beams. For example, in FIG. 39, an incident laser beam 3922 from the laser source 3904 strikes the first optical splitter 3906 whereupon the incident laser

beam is divided into a first laser beam 3924 and a second laser beam 3926. The first laser beam 3924 is directed to the first emitter 3314 where it is emitted from the housing across an operational field. The operational field may be a variety of work area, such as those found on a table saw, drill press, belt sander, lathe, or the like. The second refracted laser beam 3926 is directed towards the second optical splitter 3908. In effect, the second laser beam 3926 is the incident laser beam for the second optical splitter 3908 whereupon striking the second optical splitter the second refracted laser beam is divided into a third laser beam 3928 and a fourth laser beam 3930. The third laser beam 3928 is directed to the second emitter 3916 where it is emitted from the housing across the operational field. The fourth laser beam 3930 becomes the incident laser beam for the third optical splitter 3910. The third optical splitter 3910 divides the laser beam into a fifth laser beam 3932 and a sixth laser beam 3934. The fifth laser beam 3932 is directed to the third emitter 3918 where it is emitted from the housing across the operational field. The sixth laser beam 3934 becomes the incident laser beam for the first optical reflector 3912. The first optical reflector 3912 directs the laser beam to the fourth emitter 3920 where it is emitted from the housing across the operational field.

[0097] A single laser source may reduce the power consumption of the current invention and provide a more effective way to deal with heat build up, which is inherent within a laser beam generating source. In an alternate embodiment the laser source may be a modular laser source capable of being inserted and removed from the housing of the laser apparatus. This may increase operational safety and provide an easier method of caring for the laser source by being able to remove it and store it in a separate location. Additionally, a variety of laser sources may be enabled to couple with the housing of the laser apparatus of the current invention. Thus, the user of the laser apparatus with a modular laser source has the capability of inserting the appropriate laser source for the job to be accomplished. For example, the user may need a simple laser source for one job and then require a laser source with a dithering assembly for another job. Additionally, the user may require a smaller output laser source in one situation and a

larger output laser source in another. The needed functionality required by the user may be easily enabled with multiple modular laser sources with differing functional capabilities.

[0098] Referring now to FIG. 40, a laser apparatus 4000 is shown. In the present embodiment the laser apparatus 4000 comprises a housing 4002 coupled with a computing system 4004. Preferably, the computing system 4004 is similar to the computing systems described previously, except that in the present embodiment the computing system 4004 includes a laser source 4006. The housing includes a first optical splitter 4008, a first optical reflector 4010, a second optical splitter 4012, a third optical splitter 4014, and a second optical reflector 4016. The housing further includes a first emitter 4018, a second emitter 4020, a third emitter 4022, and a fourth emitter 4024.

[0099] The laser source 4006 emits an incident laser beam into the housing 4002 which is then split by a first optical splitter 4008 into a first laser beam 4026 and a second laser beam 4028. The first laser beam 4026 is directed to the first optical reflector 4010 where it is reflected through the first optical emitter 4018 and emitted across an operational field. The second laser beam 4028 is directed to the second optical splitter 4008 which divides the second laser beam into a third laser beam 4030 and a fourth laser beam 4032. The third laser beam 4030 is directed through the second emitter 4020 across the operational field and the fourth laser beam 4032 becomes the incident laser beam for the third optical splitter 4012. The third optical splitter 4012 divides the fourth laser beam 4032 into a fifth laser beam 4034 and a sixth laser beam 4036. The fifth laser beam 4034 is directed through the third emitter 4022 across the operation field and the sixth laser beam 4036 becomes the incident laser beam for the second optical reflector 4014. Upon striking the second optical reflector 4014, the sixth laser beam 4036 is reflected through the fourth optical emitter 4024 and emitted across the operational field.

[00100] In an additional embodiment, the laser apparatus may include an optical splitter control mechanism. This mechanism may allow a user to determine the number of laser beams emitted from the housing of the laser apparatus. This may be beneficial when the laser apparatus is being used in situations where the size of the work surface and other components are constantly changing. For example, on a table saw all four emitters may need to be engaged to cover the work surface presented. However, a drill press may have a much smaller working surface and using more than two emitters may not be beneficial to gathering the needed information as they may be outside the scope of the work surface available.

[00101] Referring now to FIG. 41, a rotation laser apparatus 4100 including a single laser source 4102, is shown. The single laser source 4102 emits an incident laser beam 4104 which is split by a first optical splitter 4106 and a second optical splitter 4108. The laser beam is also reflected by a first optical reflector 4110 and a second optical reflector 4112. The optical splitters and reflectors function in the same manner as described previously in FIGS. 39 and 40. In the present embodiment the single laser source 4102 is located within the joint 4114 connecting a first housing member 4116 to a second housing member 4118. Power may be provided through a portable power source or a power cord as described in previous figures.

[00102] A rotation laser apparatus 4200 including a first laser source 4202 and a second laser source 4204, is shown in FIG. 39. In the present embodiment a first housing member 3606 is disposed on one end with the first laser source 3602 and connected at the opposite end, through joint 3608, to a second housing member 3610. The second housing member 3610 is disposed on the opposite end of its connection to the joint 3608 with the second laser source 3604. The first housing member 3606 further includes a first optical splitter 3612 and a first optical reflector 3614. The second housing member 3610 further includes a second optical splitter 4216 and a second optical reflector 4218. The operation of the splitters and reflectors is similar to that previously described in FIGS. 39 and 40.

[00103] In both FIGS. 41 and 42 the number and configuration of optical splitters and reflectors may vary as contemplated by one of ordinary skill in the art. It is understood that the laser sources shown in the present embodiments are exemplary and may not be read as limiting or exclusive. As discussed in FIGS. 39 and 40 the laser apparatus of FIGS. 41 and 42 may include photo multipliers of various configurations in order to provide additional functionality to the laser apparatus. Alternatively, the laser sources provided in FIGS. 41 and 42 may be modular. The laser sources may be removed from the joint or the housing members and replaced with alternate laser sources.

[00104] Referring now to FIG. 43, a laser apparatus 4300 is shown. The laser apparatus 4300 comprises a housing 4302 disposed with a laser source 4304. The housing is further disposed with a first optical splitter 4306, a second optical splitter 4308, a third optical splitter 4310, and an optical reflector 4312. The functionality of the optical splitters and the optical reflector is similar to that described in FIGS. 39 through 42. Additionally, the housing includes a first emitter 4314, a second emitter 4316, a third emitter 4318 and a fourth emitter 4320.

[00105] In the present embodiment, a plurality of light signal enhancing instruments 4322, 4324, 4326, and 4328. These light signal enhancing instruments may be photomultipliers comprising a variety of designs, such as photomultiplier end-on tubes, side-on photomultipliers, or the like. The photomultipliers may accept an incident laser beam and intensify the light signal by increasing the number of electrons in order to maintain sufficient light signal strength as the laser beam is being passed down from one optical splitter to the next. Further, the light signal enhancing instruments may be positioned in front of the emitters in order to provide optimum light signal output.

[00106] Alternatively, the light signal enhancing instruments may include a secondary laser source, such that the incident laser beam received has its signal strength increased.

For example, a low power laser source may be included within the light signal enhancing instrument which contributes a second light signal to the existing laser beam in order to make up for a loss of light signal intensity. Such a system of multiple light signal enhancing instruments may decrease production costs by substituting low power laser sources for separate and independent laser sources located throughout the laser apparatus. It is understood that the configuration and numbers of light signal enhancing instruments may vary as contemplated by one of ordinary skill in the art.

[00107] Referring now to FIGS. 44, 45, and 46, a laser apparatus 4400 is shown. In the current embodiment, the laser apparatus 4400 comprises a housing 4402 including a leveling mechanism 4404 and a wireless receiver 4406. The housing 4402 further includes a communication port 4407, an attachment adapter 4408, and an attachment receiver 4410. Additionally, the housing 4402 includes a first laser source 4412, a second laser source 4414, a third laser source 4416, and a fourth laser source 4418.

[00108] The leveling mechanism 4404 enables a user to determine the level characteristics of the laser apparatus 4400 in any location. Previous embodiments of the laser apparatus showed the leveling mechanism within the mounting assembly. By placing the leveling mechanism within the housing 4402, the user may establish accurate placements in locations such as on a wall for use in mounting a drop ceiling, as shown in FIG. 46.

[00109] The laser sources 4412 through 4418 are similar to the laser sources shown and described previously. It is contemplated that a laser source may be located to emit a laser beam from either end of the housing 4402. For example, a laser source may be positioned within the attachment adapter 4408. By placing the laser source at either end of the housing the laser apparatus 4400 may be enabled to determine the level characteristics of objects located along a flat surface to which the laser apparatus 4400 is mounted, such as a picture on a wall or the like.

[00110] The wireless receiver 4406 enables communication between the laser apparatus 4400 and a computing device 4502, shown in FIG. 45. In alternate embodiments the computing system may be communicatively coupled to the laser apparatus using a variety of systems, such as serial cable, Bluetooth, Infrared, or the like. The wireless communication system allows a user to mount the laser apparatus 4400 in a remote location, such as that shown in FIG. 46, and receive information on the computing system 4502. For example, shown in FIG. 46, the laser apparatus 4400 is mounted to a wall to provide leveling information for a drop ceiling. A first laser beam 4602 and a second laser beam 4604 are shown striking a support rail 4606 for the drop ceiling. In this situation the laser apparatus may communicate to the computing system that the support rail 4606 is not level at the two identified points. A third laser beam 4608 and a fourth laser beam 4610 may provide no such indication that the support rail 4606 is out of level. Thus, a user is informed not only of the misalignment but also where along the support rail 4606 the misalignment is occurring.

[00111] The attachment adapter 4408 and the attachment receiver 4410 enable linking of one laser apparatus to another. As shown in FIG. 45, a plurality of laser apparatus 4400 may be connected. In this embodiment, the multiple laser apparatus are in communication with the computing system 4502. It is contemplated that the attachment adapter and attachment receiver provide a communicative link between each of the laser apparatus 4400 allowing a single computing system to control all connected laser apparatus. Alternately, each laser apparatus may receive the wireless signal 4504 being sent out by the computing system 4502.

[00112] It is understood that the leveling mechanism 4404 may be disposed within any of the previous embodiments of the laser apparatus, shown in FIGS. 1 or 30. It is further understood that the laser apparatus 4400 may include mounting members and latch and release mechanisms, such as those previously shown and described in FIG. 1. Additionally, a mounting assembly for connecting the laser apparatus 4400 to a wall or



other vertical surface is contemplated. The communication port 4407 enables a computing system to communicate with the laser sources 4412 through 4418. The housing 4402 of the laser apparatus 4400 may be disposed with both the wireless receiver 4406 and the communication port 4407 or one or the other.

[00113] Smooth and easy operational control over a complex technological system, such as a laser guidance, measurement, and alignment system, may be critical to the success of any device. In the power tool field, this is even more critical as a user of power tools employing complex technology is often faced with a chaotic and dangerous working environment filled with loud noises, many moving parts, dust and debris which hamper visual capabilities, and a variety of different operations which require their attention. Therefore, the control device that the user employs to control the power tool must be simple and yet effectively provide the capability to control numerous complex tasks. In the field of power tools, the control device may be referred to as the user interface. The user interface of the present invention is designed to better serve the user by focusing on providing complex technology in an easy to understand or intuitive format.

[00114] Many times when complex technologies are incorporated into existing devices, such as laser systems with power tools, the focus is on the technology and the user is forced to comprehend a bewildering array of new standards and display terminology. With the present invention the technology serves the user by joining the complexity of the laser system with a user interface that provides simple to follow and easy to understand textual and/or graphical representations. Out-of-the-box implies a level of user friendliness with the idea being that any user may take the present invention and by simply turning it on, start using it with ease. For example, when a user interface in accordance with an exemplary embodiment of the present invention is first turned on it may provide a calibration of the current settings of a power tool environment without being prompted by the user. From the calibration the user interface logically organizes and communicates the information to the user. Additionally, the user interface may

present the user with operational choices logically related through easy to identify monikers providing a smooth flow to the user's navigation through the various user interface applications. Another example of the ease of use of the current user interface may involve the use of circular saws. All circular saw blades establish a kerf during their cut. A kerf is the area of material removed by the blade during the cut. While the kerf may be a minimal value it is not always an insignificant value and a user may wish to have the ability to account for the kerf of the cut when establishing settings. The user interface of the present invention may provide an operator the capability of determining the kerf for the circular saw blade through a user selectable menu of choices with pre-programmed kerf information. In the alternative, the user interface may establish the kerf of the circular saw blade being used without operator input and adjust all settings made to account for the kerf. Another embodiment of the present invention may be the user interface being able to determine the kerf of the circular saw blade being used through identification of a marker on the blade, such as a bar code imprinted on the blade. It is understood that adaptation of the user interface for use with other types of power tools may also include the ability to account for the amount of material removed by the power tool when establishing settings for the power tool.

[00115] The correlation by the user interface of the selectors engaged by the user with the information the user sees on the display screen is an example of focusing on the user. This simple and effective design gives the user both qualitative and quantitative feedback on the various types of information the user may wish to see or adjust. The selectors may be buttons located on any surface of the user interface which provides for the appropriate correlation of the buttons with the icons on the display screen. Providing a display screen using liquid crystal display (LCD) technology is another example of focusing on the user. The LCD provides a visual field which has been proven to effectively reduce visual identification stress for a user. The color scheme and font types for the textual and graphical representations are designed to increase ease of use, even in the often dynamic working environments within which the user interface may be employed. Providing a

backlit display screen also highlights the focus of the present invention, which is on the user.

[00116] Powering the user interface of the present invention may occur through the use of batteries which are received in a battery cavity within the user interface. The user interface allows for the use of standard types of batteries for easy replacement and cost reduction. It is understood that the user interface may employ a variety of power sources, such as AC power through the use of a standard AC cord or fuel cells. Regardless of the power source used, the user interface provides a clear display to the user of the status of the power source. This may be helpful to avoid unnecessary delays caused by power failures which may have been avoided had the operator of the user interface known the status of the remaining power supply.

[00117] The user interface of the present invention may provide a computing system capable of executing applications which are visualized for the operator on a display. Thus, the user interface is enabled to receive updates to its current applications inventory or replacement of applications should the need arise. For example, the user interface may execute a specific range of applications for the operation of a power tool such as a table saw, or the like. However, the operator may wish to retro-fit the user interface on a belt sander. The belt sander will have different operating requirements and capabilities than a table saw and therefore the user interface may need to download an application set directed for the operation of a belt sander. Accomplishing this updating or replacing of applications may occur using a variety of different technologies. For instance, the user interface of the present invention may include a docking station which, when the user interface is docked, allows for a communicative link to be established between the user interface and a peripheral computing system. Thus, information may be downloaded to the user interface from the peripheral computing system and the user interface may upload information to the peripheral computing system. The user interface may be disposed with communications ports, such as a serial cable port, infrared port, RF port,

Bluetooth port, and the like, which allow it to network with peripheral computing systems.

[00118] Through a user interface of the present invention, an operator of a power tool, such as a table saw, may establish the settings and measurements to be used with the power tool. For example, a user of the table saw may set a desired fence to blade distance, blade height, blade angle, etc., through the user interface. When the feedback from the laser apparatus 100 indicates that the desired orientation has been reached it may provide an indication to the user, through the user interface. Indicators may include visual and audio feedback, and the like. For example, a sound feedback mechanism provided by a user interface of the present invention may present an audible signal to a user when a tool is in the selected position (e.g., when a saw blade has a desired height or angle, when a fence is in a desired distance from a saw blade, or the like). In a variation of this mechanism, the sound feedback mechanism may emit via a microphone/speaker a series of beeps or other noises to a user that guide the user in the positioning of the tool. For example, the beeps may become louder, more frequent, and/or change in pitch the closer the tool is to the desired position. Alternatively, a user interface of the present invention may provide visual feedback mechanism (not shown) which presents a visual signal on its display. For example, this visual signal may be as simple as a light or other symbol being displayed on the display of the user interface when the tool is in the desired position. In a variation of the visual feedback mechanism, arrows or other visual direction-guiding signals may be presented on the display to guide the user to the desired position of the tool.

[00119] A user interface in accordance with the present invention may be coupled with a laser measurement and alignment device. The laser measurement and alignment device may comprise the laser apparatus 100 and computing system 104 shown and described in FIGS. 1 through 46 or may comprise a variety of systems as contemplated by one of ordinary skill in the art. The coupling may enable the user interface to be selectively or

permanently detached from the laser measurement and alignment device. The user interface may communicate with the laser measurement and alignment device via a physical communication line (such as a cable) or via a wireless signal. It is contemplated that the user interface may couple directly with the laser apparatus 100 or may communicatively couple with the computing system 104 which in turn is coupled with the laser apparatus 100. The communicative coupling may allow the user interface to operatively control the laser apparatus 100 from a remote location. Thus, the user interface may control a power tool, upon which the laser measurement and alignment device is coupled, from a remote location.

[00120] In an exemplary embodiment, the interface may include its own power supply so that the interface may transmit signals to the laser measurement and alignment device when detached therefrom. Alternatively, the interface and the laser measurement and alignment device may share a single power source. The power source may be batteries, fuel cells, or the like. In a further embodiment of the present invention, the user interface may include laser sources, similar to those shown and described for the computing system 104. Moreover, the software loaded onto a user interface may be updated through a diskette, a DVD, a CD, the Internet, a network, or the like.

[00121] According to an exemplary embodiment of the present invention, a user interface may include a display which shows exemplary screens 4700 through 5300 shown in FIG. 47 through 53. As shown in FIG. 47 through 53, each screen includes four tabs: a home tab (labeled with a “home” icon), a settings tab (labeled with a “gear” icon), a calibration tab (labeled with a “reversed triangle” icon), and a save tab (labeled with a “diskette” icon). A user may toggle among different screens by touching an appropriate tab.

[00122] As shown in FIG. 47, an exemplary home screen 4700 is shown. The screen 4700 shows a distance icon and its corresponding value (“12¼”), an angle icon and its corresponding value (6.1°), and a height icon and its corresponding value (“1¼”). From

the screen 4700 shown in FIG. 47, when the settings tab is touched, the screen 4700 may be replaced with a settings screen 4800 shown in FIG. 48. The screen 4800 may show information such as the battery status of the user interface or the laser measurement and alignment device, and the like. From the screen 4800 shown in FIG. 48, when the calibration tab is touched, the screen 4800 may be replaced with a calibration screen 4900 shown in FIG. 49. Through the calibration screen 4900, a user may calibrate the laser measurement and alignment device. From the screen 4900 shown in FIG. 49, when the save tab is touched, the screen 4900 may be replaced with a save screen 5000 shown in FIG. 50, through which a user may save a height. FIG. 51 shows an additional exemplary save screen 5100, through which a user may save a distance. FIG. 52 shows a further exemplary save screen 5200, through which a user may save an angle. FIG. 53 shows a still further exemplary save screen 5300, which shows various other exemplary icons (e.g., a speak icon for adjusting the volume of the speaker, and the like).

[00123] It is understood that the foregoing-described screens shown in FIGS. 47 through 53 are intended as exemplary only and not as a limitation to the present invention. Those of ordinary skill in the art will appreciate that various combinations and arrangements may be employed without departing from the scope and spirit of the present invention.

[00124] A user interface coupled with a laser measurement and alignment device in accordance with an exemplary embodiment of the present invention may operate according to a scheme 5400 shown in FIG. 54. As shown in FIG. 54, when a laser measurement and alignment device and a user interface are not attached to a power tool (e.g., a table saw, belt sander, lathe, drill press, nailer, router table, and the like), the laser measurement and alignment device and the user interface may be used to do other measurements unrelated to the power tool or may be recharged. Additionally, the software loaded onto the user interface may be updated. For instance, the user interface may include a disk drive for loading software applications and saving information onto a removeable memory media. Alternatively, the user interface may include a drive for a

DVD, a CD-ROM, flash memory devices, and the like, for receiving software updates. When a laser measurement and alignment device and a user interface are attached to a power tool (e.g., a table saw, or the like), the laser measurement and alignment device and the user interface may be used to perform measurements on the power tool. Additionally, the laser measurement and alignment device may be automatically calibrated through the user interface.

[00125] In one embodiment of the present invention, a user interface may include four operational modes: distance, angle, height, and settings, as shown in FIG. 54.

[00126] In a distance mode, a user may set a desired distance, e.g., a distance between a saw blade and fence of a table saw through the user interface. In the exemplary embodiment shown in FIG. 54, the user interface in a distance mode may include five options: (1) return to home state; (2) fine adjustment; (3) recall dimension (i.e., recall a previous saved distance); (4) save dimension (i.e., save the current distance); and (5) back one level. Under the fine adjustment option, the user interface may include three options: (1) zero dimension, either absolute or relative; (2) units (fraction, decimal, or metric); and (3) add offset distance.

[00127] In an angle mode, a user may set a desired angle, e.g., an angle between a saw blade and a line perpendicular to a table surface of a table saw through the user interface. As shown in FIG. 54, the user interface in an angle mode may include five options: (1) return to home state; (2) fine adjustment; (3) recall angle (i.e., recall a previous saved angle); (4) save dimension (i.e., save the current angle); and (5) back one level. Under the fine adjustment option, the user interface may include two options: (a) zero dimension (either absolute or relative); and (b) compute an angle (a result based on miter and bevel).

[00128] In a height mode, a user may set a desired height, e.g., a height of a saw blade over a table surface of a table saw through the user interface. As shown in FIG. 54, the

user interface in a height mode may include five options: (1) return to home state (the interface directly returns to a home screen when this option is chosen); (2) fine adjustment; (3) recall dimension (i.e., recall a previous saved height); (4) save dimension (i.e., save the current height); and (5) back one level (the interface goes back one level when this option is chosen). Under the fine adjustment option, the user interface may include two options: (a) zero height (either absolute or relative); and (b) units (fraction, decimal, or metric).

[00129] In a settings mode, a user may set desired settings for the user interface. As shown in FIG. 54, the user interface in a settings mode may include five options: (1) return to home state; (2) global units; (3) calibration; (4) system; and (5) back one level. Under the global units option, the user interface may include three options: (a) fraction; (b) decimal; and (c) metric. The default unit may be fraction. Under the fraction unit, a user may choose a resolution such as  $1/128$ ,  $1/64$ ,  $1/32$ , or the like. Under the decimal unit, a user may choose a resolution such as 0.0, 0.00, 0.000, or the like. Under the calibration option, the user interface may include three options: (a) measurements (distance, angle or height); (b) fence side (either left or right); (c) fence orientation (either horizontal or vertical). Under the system option, the user interface may include three options: (a) sound (either on or off); (b) display (to adjust brightness and contrast of the display); and (c) laser. Under the laser option, the user interface may include three options: (i) on (laser is on for 10 seconds, 20 seconds, 30 seconds, or the like); (ii) off (laser is off); and (iii) sleep mode (laser falls asleep after laser is on for 10 seconds, 20 seconds, 30 seconds, or the like). Additionally, under the system option, a user may update the software loaded onto the user interface.

[00130] It is understood that the number of modes and options available under each mode and the variety of operations which may be performed by the user interface may vary without departing from the scope and spirit of the present invention. For instance, other options under the save dimension option, found under the distance mode, angle mode,



and height mode, may include: (1) save to diskette, (2) save to CDR, and (3) save to flash media. Additionally, each screen in a particular mode may include an icon for accessing the other modes directly. For example, under the distance mode each screen presented to the user of the user interface may include an icon for the angle mode, height mode, and setting mode. By selecting the individual icon the user may be taken directly to the selected mode and presented with the series of options available under that mode.

[00131] FIG. 55 shows an exemplary user interface 5800 with different exemplary screens which may execute the scheme 5400 shown in FIG. 54. FIG. 56 shows the user interface 5800 with an exemplary calibration screen, and FIG. 57 shows the user interface 5800 with an additional exemplary calibration screen. The user interface 5800 will be described in detail along with FIG. 58.

[00132] Referring now to FIG. 58, the exemplary user interface 5800 will be described in more detail. The interface 5800 includes a display 5802 and a plurality of user input controls, which are generally indicated at 5804. The display 5802 may be LCD (liquid crystal display), a pixel-based display, or the like. As shown, the controls 5804 include a plurality of push (or enter) buttons 5806, 5808, 5810, 5812 and 5814. The buttons 5806 through 5814 enable a user to toggle between the screens and modes displayable on the display 5802, and to select and input values for any of the available options, as discussed in more detail subsequently. In FIG. 58, the buttons 5806 through 5814 are positioned at the bottom of the interface 5800 and correlate with an option on the display 5802 available for selection by the user. However, the buttons 5806 through 5814 may be positioned anywhere on the interface 5800 as may be contemplated by a person of ordinary skill in the art. In the exemplary embodiment shown, the buttons 5806 through 5814 are all enter buttons. However, it is within the scope of the present invention that other configurations and numbers of buttons may be used. Similarly, other forms of user input controls may be used, such as slides, track balls, switches, and pointing devices. Of course, although the described user interface is relatively large and complex, it is also

possible to provide a much smaller user interface with less information displayed at a time.

[00133] FIG. 58 illustrates a default, or home, screen 5816 of the display 5802. This is the screen that is most often displayed to a user, and to which the controller defaults after user inputs are completed on any of the subsequently described screens. As shown, the display 5802 (and hence each screen of the display 5802, including the home screen 5816) includes a battery region 5818, a developer region 5820, a current-screen region 5822, a settings region 5824 and an available-option region 5826.

[00134] The battery region 5818 provides a user with information about the status of batteries used to provide power to the laser measurement and alignment device and the user interface 5800. This feature is useful to allow a user to monitor the status of the battery during use. In particular, a user may want to check the remaining battery capacity before starting a project that may require more battery reserve than currently available. As shown, the battery region 5818 includes a small battery icon 5828 and a large battery icon 5830. Each of the icons 5828 and 5830 has incremental bar-graph-like readings representing the theoretical amount of battery life remaining. It is understood other textual or symbolic representations may be used without departing from the scope and spirit of the present invention. The icon 5828 may be used to indicate the status of the battery used to provide power to one of the user interface 5800 and the laser measurement and alignment device (e.g. the user interface 5800), and the icon 5830 may be used to indicate the status of the battery used to provide power to the other of the user interface 5800 and the laser measurement and alignment device (e.g., the laser measurement and alignment device). Alternatively, the battery region 5818 may include a single icon of a battery with incremental bar-graph-like readings representing the theoretical amount of battery life remaining when the battery is used to provide power to both the laser measurement and alignment device and the user interface 5800. It is

understood that the battery region 5818 may be positioned on the display 5802 as may be contemplated by a person of ordinary skill in the art.

[00135] The developer region 5820 may provide various information, such as identifying the developer of the user interface 5800. Alternatively, the developer region 5820 may be not included in the display 5802 at all in order to save space. In another embodiment the developer region 5820 may provide an indication of ownership of the individual user interface. For example, a user may place a specific logo in this region to identify the user interface as their own. It is understood that the location and configuration of the developer region on the display 5802 may vary. For instance, the developer region may be sub-divided into multiple sub-regions. Further, each user interface may be enabled with a security feature which allows the individual unit to be protected from unauthorized use by another. For example, the security feature may include a user being able to enter a password into the user interface which is required before operation of the user interface will be allowed. It is contemplated that other security features may be incorporated into the present invention as contemplated by one of ordinary skill in the art.

[00136] The current-screen region 5822 is used to show the screen status of the user interface 5800 and will be described in more detail subsequently. As shown in FIG. 58, the current-screen region 5822 of the home screen 5816 is empty. Alternatively, the current-screen region 5822 of the home screen 5816 may include graphic and/or textual representations indicating that the present screen is the home screen.

[00137] The settings region 5824 displays information to the user about the current setup of programmed and user-selected modes for the tool (e.g., a table saw, or the like). As shown in FIG. 58, the region 5824 includes at least one mode icon 5832 and its (their) corresponding value(s) 5834. For example, as shown in FIG. 58, three operational mode icons are shown on the home screen 5816, each of which has at least one value. The three illustrated mode icons are distance 5836, angle 5840, and height 5844, each of

which having a corresponding value 5838, 5842, and 5846, respectively, and may trigger the display of one or more additional screens, as described in more detail subsequently. It should be understood that the textual names for the modes may be used in place of or in conjunction with the mode icons. Additionally, although FIG. 58 shows a mode icon positioned below its corresponding value, other arrangements may be utilized as may be contemplated by a person of ordinary skill in the art. For example, a mode icon (and/or textual name) may be positioned to the left, to the right, or above its corresponding value without departing from the scope and spirit of the present invention.

[00138] Preferably, the distance value 5838, the angle value 5842, and the height value 5846 in the settings region 5824 are all displayed in a clear fashion to a user so that the user is not confused by the numbers inside these values. Different fonts, sizes, and/or color may be used to distinguish different numbers. It is understood that visual clarity and the ease with which an operator of the user interface can view the information presented on the display 5802 may implicitly establish a preferable range of fonts, sizes, and colors used by the user interface. Further, the amount of information to be presented on each screen of the display 5802 may determine/establish a range of fonts, sizes, and colors to be used. This is another example of the user focus of the present invention, making complex technology available in a simple and effective manner. If a number is presented as an integer plus a fraction, the integer may be preferably presented in a larger font than a numerator and a denominator of the fraction. For example, as shown in FIG. 58, the distance value 5838 is “5¼” in which the number “5¼” is an integer “5” plus a fraction “¼”, and the height value is “2<sup>1</sup>/<sub>16</sub>” in which the number “2<sup>1</sup>/<sub>16</sub>” is an integer “2” plus a fraction “<sup>1</sup>/<sub>16</sub>”. The integers “5” and “2” are presented in a larger font than the numerator “1” and the denominators “4” and “6” so that a user is not confused by the numbers in the values 5838 and 5846. Moreover, if a value includes a decimal expansion of a number, the decimal digit(s) before the decimal point may be preferably presented in a larger font than the decimal digit(s) after the decimal point. For example, as shown in FIG. 58, the angle value 5842 includes a decimal expansion “5.<sup>1</sup>”. The decimal digit “5”

before the decimal point is presented in a larger font than the decimal point “1” after the decimal point so that a user is not confused by the numbers in the value 5842. It is understood that other methods as may be contemplated by a person of ordinary skill in the art may be used to distinguish numbers in a value 5834 so that a user is not confused by those numbers.

[00139] For each screen of the display 5802 of the interface 5800, the available-option region 5826 has a plurality of tabs used to show available options a user may have from the current screen. Each of the tabs may use an icon, textual, and/or graphic representation to indicate an option available from the current screen. Each of the tabs is correlated to a user input control (e.g., a button, touch pad, and the like). To choose an option representing a tab, a corresponding user input control may be operated on (e.g., a corresponding button is pushed, or the like). In a preferred embodiment, as shown in FIG. 58, each tab is correlated to a button directly below. This correlation of location, establishing a user input control in direct physical proximity to the tab, provides an ease of use of the present invention generally not seen in the art.

[00140] On the home screen 5816 shown in FIG. 58, the available-option region 5826 has five tabs 5848, 5850, 5852, 5854, and 5856, each of them is correlated to a button directly below. It is noted that although each tab on the home screen 5816 as shown in FIG. 58 uses an icon to represent an available option, any of the tabs may alternatively use a textual and/or graphic representation to indicate an available option without departing from the scope and spirit of the present invention.

[00141] As shown in FIG. 58, the tab 5848 is labeled with a “home” icon filled with color different from the background, indicating the current screen is the home screen 5816. Moreover, the tab 5848 may be marked differently from the four other tabs (e.g., the tab 5848 in FIG. 58 has no horizontal line above the “home” icon) to indicate that the current screen is the home screen 5816. The tab 5848 is correlated to the button 5806. When the

button 5806 is pushed, the home screen 5816 remains (since the current screen is the home screen).

[00142] As shown in FIG. 58, the tab 5850 has a “distance” icon representing an option of setting the distance between the saw blade and the fence and is correlated to the button 5808. From the home screen 5816 shown in FIG. 58, when the button 5808 is pushed, the home screen 5816 is replaced with a distance screen 6300 shown in FIG. 63, and the user interface 5800 enters into a distance mode. The distance screen 6300 may then be replaced with other exemplary screens in a distance mode shown in FIG. 59 and FIGS. 64 through 74 when an appropriate button (or buttons) is pushed.

[00143] As shown in FIG. 58, the tab 5852 has an “angle” icon representing an option of setting the angle between the saw blade and a line perpendicular to the surface of the saw table (usually less than  $90^\circ$ ) and is correlated to the button 5810. From the home screen 5816 shown in FIG. 58, when the button 5810 is pushed, the home screen 5816 is replaced with an angle screen 7500 shown in FIG. 75, and the user interface 5800 enters into an angle mode. The angle screen 7500 may then be replaced with other exemplary screens in an angle mode shown in FIG. 60 and FIGS. 76 through 83 when an appropriate button (or buttons) is pushed.

[00144] As shown in FIG. 58, the tab 5854 has a “height” icon representing an option of setting the height of the saw blade over the saw table surface and is correlated to the button 5812. From the home screen 5816 shown in FIG. 58, when the button 5812 is pushed, the home screen 5816 is replaced with a height screen 8400 shown in FIG. 84, and the user interface 5800 enters into a height mode. The height screen 6300 may then be replaced with other exemplary screens in a height mode shown in FIG. 61 and FIGS. 85 through 94 when an appropriate button (or buttons) is pushed.

[00145] As shown in FIG. 58, the tab 5856 has a “gear” icon representing an option of adjusting the settings of the graphic user interface 5800 and/or the laser measurement and alignment device and is correlated to the button 5814. From the home screen 5816 shown in FIG. 58, when the button 5814 is pushed, the home screen 5816 is replaced with a settings screen 9500 shown in FIG. 95, and the user interface 5800 enters into a settings mode. The settings screen 9500 may then be replaced with other exemplary screens in a settings mode shown in FIG. 62 and FIGS. 96 through 101 when an appropriate button (or buttons) is pushed.

[00146] The focus of the user interface is to provide a system which enables complex operations through an easy to use controller. In order to accomplish this goal the present invention has employed the standard of logically relating the folders which contain the various operational functions enabled by the user interface. For instance, after the user interface is calibrated a home screen 5816 provides access to distance mode FIGS. 63 through 74, angle mode FIGS. 75 through 83, height mode FIGS. 84 through 94, and settings mode FIGS. 95 through 101. When one of the modes is selected it provides access to the relevant operations pertaining to that mode in a clear and concise manner. Thus, the navigation through the complex user interface is made simple and provides a smooth flow of operation.

[00147] Referring generally now to FIGS. 63 through 74, various exemplary screens 6300 through 7400 of the display 5802 of the user interface 5800 in a distance mode are shown. Referring to FIG. 63, the distance screen 6300 is similar to the home screen 5816 shown in FIG. 58. However, in its settings region 5824 the distance screen 6300 shows the distance mode icon 5836 and its corresponding value 5838 only. In a preferred embodiment, when the user interface 5800 is in a distance mode, only the distance mode icon 5836 and its corresponding value 5838 are shown in the settings region 5824 (see, e.g., FIGS. 63 through 74). Preferably, a user sets only a desired distance between a saw blade and a fence of a table saw through the user interface 5800 when the user interface

5800 is in a distance mode. Because a user does not set an angle or a blade height in a distance mode, the angle and the height mode icons 5840, 5844 and their corresponding values 5842, 5846 do not need to be displayed on the screen in order to save battery power. Moreover, a screen in a distance mode showing only the distance mode icon 5836 and its corresponding value 5838 in the settings region 5824 may help a user to focus attention on setting the distance.

[00148] As shown in FIG. 63, the distance screen 6300 has in its available-option region 5826 five tabs 6302, 6304, 6306, 6308, and 6310 different from the five tabs shown in FIG. 58. The tab 6302 has a “home” icon unfilled with color representing an option of “returning to home directly” and is correlated to the button 5806 directly below. When the button 5806 is pushed, the distance screen 6300 is replaced with the home screen 5816 shown in FIG. 58. The tab 6304 represents an option of “fine adjustment” and is correlated to the button 5808 directly below. The tab 6306 represents an option of “recall” and is correlated to the button 5810 directly below. The tab 6308 has a “diskette” icon representing an option of “save” and is correlated to the button 5812 directly below. As mentioned previously, it is contemplated that other removable memory media may be employed with the present invention, such as a DVD, CDR, flash media device, and the like. Therefore, the “diskette” icon may be altered to provide an alternative image more directly reflecting the current memory media being employed. Further, it is understood that the user interface may incorporate the usage of more than one type of memory media and thus include multiple memory media drives.

[00149] The tab 6310 has a “back arrow” icon representing an option of “back one level” and is correlated to the button 5814 directly below. That is, when the button 5814 is pushed, the interface 5800 goes back one level and the distance screen 6300 is replaced with the home screen 5816 shown in FIG. 58.



[00150] From the distance screen 6300 shown in FIG. 63, when the button 5808 is pushed, the distance screen 6300 is replaced with a distance fine adjustment screen 6400 shown in FIG. 64. As shown, the screen 6400 shows in its current-screen region 5822 a textual representation “Fine Adjust”, indicating to a user that the current screen is for fine adjustment of a distance. The screen 6400 has five tabs: the tabs 6302 and 6310 (as shown in FIG. 63), a tab 6402 for a “Zero” option correlated to the button 5808, a tab 6404 for “Units” option correlated to the button 5810, and a tab 6406 for “Offset” option correlated to the button 5812. When the tab 6302 is chosen (e.g., by pushing the button 5806) from the screen 6400, the interface 5800 directly returns to home and the screen 6400 is replaced with the home screen 5816 shown in FIG. 58. When the tab 6310 is chosen (e.g., by pushing the button 5814) from the screen 6400, the interface 5800 goes back one level and the screen 6400 is replaced with the distance screen 6300 shown in FIG. 63.

[00151] When the “Zero” option is chosen (e.g., by pushing the button 5808) from the screen 6400, the screen 6400 is replaced with a distance relative zero screen 6500 shown in FIG. 65. As shown in FIG. 65, the screen 6500 has in its current-screen region 5822 a word “Zero”, indicating the current screen 6500 is a distance zero screen. Additionally, the screen 6500 has in its settings region 5824 a letter “R”, indicating that the current screen 6500 is a distance relative zero screen. This is further shown by different representations of two new tabs 6502 and 6504 on the screen 6500, where the tab 6504 representing a distance relative zero option does not have a horizontal line above the word “Relative”, indicating the distance relative zero option is chosen. Using the buttons 5808 and 5810, a user may toggle between the distance relative zero screen 6500 shown in FIG. 65 and a distance absolute zero screen (not shown).

[00152] When the “Units” option is chosen (e.g., by pushing the button 5810) from the screen 6400, the screen 6400 is replaced with a default distance units screen 6600 shown in FIG. 66. As shown in FIG. 66, the screen 6600 has in its current-screen region 5822 a

distance icon and a word “Units”, indicating the current screen 6600 is a distance units screen. The screen 6600 includes three new tabs 6602 (Frac), 6604 (Dec) and 6606 (mm), which represent a fraction unit option, a decimal unit option, and a metric unit option, respectively. The tab 6602 representing a fraction unit option does not have a horizontal line above “Frac”, indicating the fraction unit option is chosen. As a result of this option, the number in the distance value 5838 is displayed in a format of “integer + fraction” (see, e.g., “5¼” in FIG. 66).

[00153] From the screen 6600 shown in FIG. 66, when the button 5810 is pushed, the screen 6600 is replaced with a distance decimal unit screen 6700 shown in FIG. 67. As shown in FIG. 67, the screen 6700 has in its current-screen region 5822 a distance icon and words “Dec Units”, indicating the current screen 6700 is a distance decimal units screen. The tab 6604 representing a decimal unit option does not have a horizontal line above “Dec”, indicating the decimal unit option is chosen. As a result of this option, the number in the distance value 5838 is displayed in a format of a decimal expansion (see, e.g., “5.<sup>25</sup>” in FIG. 67). Using the buttons 5808, 5810, and 5812, a user may toggle among the default distance units (in fraction units) screen 6600 shown in FIG. 66, the distance decimal units screen 6700 shown in FIG. 67, and a distance metric unit screen (not shown).

[00154] When the “Offset” option is chosen (e.g., by pushing the button 5812) from the screen 6400 shown in FIG. 64, the screen 6400 is replaced with a distance offset screen 6800 shown in FIG. 68. As shown in FIG. 68, the screen 6800 has in its current-screen region 5822 a word “Offset”, indicating the current screen 6800 is a distance offset screen. The screen 6800 includes a new tab 6802 (Set), representing an option of adding an offset distance.

[00155] From the distance screen 6300 shown in FIG. 63, when the button 5810 is pushed, the distance screen 6300 is replaced with a distance recall screen 6900 shown in FIG. 69.

As shown, the screen 6900 shows in its current-screen region 5822 a textual representation “Recall”, indicating to a user that the current screen is for recalling a saved distance. There may exist at least one saved distance value in a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800. Each saved distance value may have a label number such as 1, 2, 3, etc. For example, the screen 6900 shows a value 5838 (“ $5\frac{1}{4}$ ”) in its settings region 5824. The number “1” to the left of “ $5\frac{1}{4}$ ” indicates that the label number for “ $5\frac{1}{4}$ ” is “1”. The screen 6900 includes two new tabs: a tab 6902 for a “+” option of moving to a saved distance value with a higher label number than that shown on the current screen, and a tab 6904 for a “-” option of moving to a saved distance value with a lower label number than that shown on the current screen. For example, from the screen 6900 shown in FIG. 69, when the “+” option (the tab 6902) is chosen, the screen 6900 is replaced with a screen 7000 shown in FIG. 70, where a saved distance value with a higher label number “2” (“ $2\frac{3}{64}$ ”) is shown. Additionally, from the screen 6900 shown in FIG. 69, when the “+” option is repeatedly chosen several times (e.g., by pushing the button 5808 several times), the screen 6900 may be replaced with a screen 7100 shown in FIG. 71, where a saved distance value with a higher label number “9” (“ $12\frac{7}{8}$ ”) is shown. From the screen 7100 shown in FIG. 71, when the “-” option (the tab 6904) is chosen, the screen 7100 is replaced with a screen 7200 shown in FIG. 72, where a saved distance value with a lower label number “8” (“ $3\frac{3}{8}$ ”) is shown.

[00156] From the distance screen 6300 shown in FIG. 63, when the button 5812 is pushed, the distance screen 6300 may be replaced with a distance save screen 7300 shown in FIG. 73. As shown, the screen 7300 shows in its current-screen region 5822 a diskette icon and a textual representation “Save”, indicating to a user that the current screen is for saving a distance value. The screen 7300 includes a “diskette” tab 7302, representing an option of saving the current value 5838 (“ $6\frac{1}{2}$ ”). When the tab 7302 is chosen from the screen 7300, the screen 7300 is replaced with the screen 7400 shown in FIG. 74, where the value “ $6\frac{1}{2}$ ” is given a label number (e.g., “11” shown in FIG. 74) and may be saved

into a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800.

[00157] It is contemplated that an operator of the user interface may input changes to the distance settings directly. For example, under the distance fine adjustment screen an alternative user input control mode may be included which allows the user to directly affect changes in the distance settings. The user may be enabled to make corrections to the distance in incremental amounts, such as  $\frac{1}{2}$  inch or  $\frac{1}{4}$  inch, .1" or .01", or 10mm or 5mm. The user interface may provide "+" and "-" tabs correlated to user input control buttons which allow for this type of adjustment. The direct change of distance setting may be configured in a variety of ways and be within various locations of the height mode as contemplated by one of ordinary skill in the art.

[00158] Referring generally now to FIGS. 75 through 83, various exemplary screens 7500 through 8300 of the display 5802 of the user interface 5800 in an angle mode are shown. Referring to FIG. 75, the angle screen 7500 is similar to the home screen 5816 shown in FIG. 58. However, in its settings region 5824 the angle screen 7500 shows the distance mode icon 5840 and its corresponding value 5842 only. In a preferred embodiment, when the user interface 5800 is in an angle mode, only the angle mode icon 5840 and its corresponding value 5842 are shown in the settings region 5824 (see, e.g., FIGS. 75 through 83). Preferably, a user sets only a desired angle between a saw blade and a line perpendicular to the table surface of a table saw through the user interface 5800 when the user interface 5800 is in an angle mode. Because a user does not set a distance or a blade height in an angle mode, the distance and the height mode icons 5836, 5844 and their corresponding values 5838, 5846 do not need to be displayed on the screen in order to save battery power. Moreover, a screen in an angle mode showing only the angle mode icon 5840 and its corresponding value 5842 in the settings region 5824 may help a user to focus attention on setting the angle.

[00159] As shown in FIG. 75, the angle screen 7500 shows in its current-screen region 5822 an angle icon and a textual representation “Angle”, indicating to a user that the current screen is in an angle mode. As shown, the screen 7500 has in its available-option region 5826 five tabs 6302, 6304, 6306, 6308, and 6310 different from the five tabs shown in FIG. 58. The tab 6302 has a “home” icon unfilled with color representing an option of “returning to home directly” and is correlated to the button 5806 directly below. When the button 5806 is pushed, the angle screen 7500 is replaced with the home screen 5816 shown in FIG. 58. The tab 6304 represents an option of “fine adjustment” and is correlated to the button 5808 directly below. The tab 6306 represents an option of “recall” and is correlated to the button 5810 directly below. The tab 6308 has a “diskette” icon representing an option of “save” and is correlated to the button 5812 directly below. The tab 6310 has a “back arrow” icon representing an option of “back one level” and is correlated to the button 5814 directly below. That is, when the button 5814 is pushed, the interface 5800 goes back one level and the angle screen 7500 is replaced with the home screen 5816 shown in FIG. 58.

[00160] From the angle screen 7500 shown in FIG. 75, when the button 5808 is pushed, the angle screen 7500 is replaced with an angle fine adjustment screen 7600 shown in FIG. 76. As shown, the screen 7600 shows in its current-screen region 5822 an angle icon and a textual representation “Fine Adjust”, indicating to a user that the current screen is for fine adjustment of an angle. The screen 7600 includes three tabs: the tabs 6302 and 6310 (as shown in FIG. 75), and a tab 6402 for a “Zero” option correlated to the button 5808. When the tab 6302 is chosen (e.g., by pushing the button 5806) from the screen 7600, the interface 5800 directly returns to home and the screen 7600 is replaced with the home screen 5816 shown in FIG. 58. When the tab 6310 is chosen (e.g., by pushing the button 5814) from the screen 7600, the interface 5800 goes back one level and the screen 7600 is replaced with the angle screen 7500 shown in FIG. 75.

[00161] When the “Zero” option is chosen (e.g., by pushing the button 5808) from the screen 7600 shown in FIG. 76, the screen 7600 is replaced with an angle zero screen 7700 shown in FIG. 77. As shown in FIG. 77, the screen 7700 has in its current-screen region 5822 an angle icon and a word “Zero”, indicating the current screen 7700 is an angle zero screen. The screen 7700 includes two new tabs: a tab 7702 representing an angle absolute zero option, and a tab 7704 representing an angle relative zero option. When the tab 7704 option is chosen (e.g., by pushing the button 5810) from the screen 7700 shown in FIG. 77, the screen 7700 is replaced with an angle relative zero screen 7800 shown in FIG. 78. As shown in FIG. 78, the screen 7800 has in its current-screen region 5822 an angle icon and a word “Relative”, indicating the current screen 7800 is an angle relative zero screen. Using the buttons 5808 and 5810, a user may toggle between the angle relative zero screen 7800 shown in FIG. 78 and the angle zero screen 7700 shown in FIG. 77.

[00162] From the angle screen 7500 shown in FIG. 75, when the button 5810 is pushed, the angle screen 7500 is replaced with an angle recall screen 7900 shown in FIG. 79. As shown, the screen 7900 shows in its current-screen region 5822 an angle icon and a textual representation “Recall”, indicating to a user that the current screen is for recalling a saved angle. There may exist at least one saved angle value in a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800. Each saved angle value may have a label number such as 1, 2, 3, etc. For example, the screen 7900 shows a value 5842 (“15.1°”) in its settings region 5824. The number “2” to the left of “15.1°” indicates that the label number for “15.1°” is “2”. The screen 7900 includes two new tabs: a tab 7902 for a “+” option of moving to a saved angle value with a higher label number than that shown on the current screen, and a tab 7904 for a “-” option of moving to a saved angle value with a lower label number than that shown on the current screen. For example, from the screen 7900 shown in FIG. 79, when the “+” option (the tab 7902) is chosen (several times), the screen 7900 may be replaced with a screen 8000 shown in FIG. 80,

where a saved angle value with a label number “5” (“30.0°”) is shown. Additionally, from the screen 7900 shown in FIG. 79, when the “-” option (the tab 7904) is chosen, the screen 7900 may be replaced with a screen 8100 shown in FIG. 81, where a saved angle value with a lower label number “1” (“7.5°”) is shown.

[00163] From the angle screen 7500 shown in FIG. 75, when the button 5812 is pushed, the angle screen 7500 is replaced with an angle save screen 8200 shown in FIG. 82. As shown, the screen 8200 shows in its current-screen region 5822 an angle icon and a textual representation “Save”, indicating to a user that the current screen is for saving an angle value. The screen 8200 includes a “diskette” tab 8202, representing an option of saving the current value 5842 (“41.0°”). As mentioned previously, it is contemplated that other removable memory media may be employed with the present invention, such as a DVD, CDR, flash media device, and the like. Therefore, the “diskette” icon may be altered to provide an alternative image more directly reflecting the current memory media being employed. Further, it is understood that the user interface may incorporate the usage of more than one type of memory media and thus include multiple memory media drives.

[00164] When the tab 8202 is chosen from the screen 8200, the screen 8200 is replaced with a screen 8300 shown in FIG. 83, where the value “41.0°” is given a label number (e.g., “9” shown in FIG. 83) and may be saved into a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800.

[00165] It is contemplated that an operator of the user interface may input changes to the angle settings directly. For example, under the angle fine adjustment screen an alternative user input control mode may be included which allows the user to directly affect changes in the angle settings. The user may be enabled to make corrections to the angle in incremental amounts, such as .5 degrees or 1 degree. The user interface may

provide “+” and “-” tabs correlated to user input control buttons which allow for this type of adjustment. The direct change of angle setting may be configured in a variety of ways and be within various locations of the angle mode as contemplated by one of ordinary skill in the art.

[00166] Referring generally now to FIGS. 84 through 94, various exemplary screens 8400 through 9400 of the display 5802 of the user interface 5800 in a height mode are shown. Referring to FIG. 84, the height screen 8400 is similar to the home screen 5816 shown in FIG. 58. However, in its settings region 5824 the height screen 8400 shows the height mode icon 5844 and its corresponding value 5846 only. In a preferred embodiment, when the user interface 5800 is in a height mode, only the height mode icon 5844 and its corresponding value 5846 are shown in the settings region 5824 (see, e.g., FIGS. 84 through 94). Preferably, a user sets only a desired height of a saw blade over a table surface of a table saw through the user interface 5800 when the user interface 5800 is in a height mode. Because a user does not set a distance or an angle in a height mode, the distance and angle mode icons 5836, 5840 and their corresponding values 5838, 5842 do not need to be displayed on the screen in order to save battery power. Moreover, a screen in a distance mode showing only the height mode icon 5844 and its corresponding value 5846 in the settings region 5824 may help a user to focus attention on setting the distance.

[00167] As shown in FIG. 84, the height screen 8400 shows in its current-screen region 5822 a height icon and a textual representation “Height”, indicating to a user that the current screen is in a height mode. As shown, the height screen 8400 has in its available-option region 5826 five tabs 6302, 6304, 6306, 6308, and 6310 different from the five tabs shown in FIG. 58. The tab 6302 has a “home” icon unfilled with color representing an option of “returning to home directly” and is correlated to the button 5806 directly below. When the button 5806 is pushed, the distance screen 6300 is replaced with the home screen 5816 shown in FIG. 58. The tab 6304 represents an option of “fine



adjustment” and is correlated to the button 5808 directly below. The tab 6306 represents an option of “recall” and is correlated to the button 5810 directly below. The tab 6308 has a “diskette” icon representing an option of “save” and is correlated to the button 5812 directly below. The tab 6310 has a “back arrow” icon representing an option of “back one level” and is correlated to the button 5814 directly below. That is, when the button 5814 is pushed, the interface 5800 goes back one level and the distance screen 8400 is replaced with the home screen 5816 shown in FIG. 58.

[00168] From the height screen 8400 shown in FIG. 84, when the button 5808 is pushed, the height screen 8400 is replaced with a height fine adjustment screen 8500 shown in FIG. 85. As shown, the screen 8500 shows in its current-screen region 5822 a height icon and a textual representation “Fine Adjust”, indicating to a user that the current screen is for fine adjustment of a height. The screen 8500 has five tabs: the tabs 6302 and 6310 (as shown in FIG. 84), a tab 8502 for a “Zero” option correlated to the button 5808, a tab 8504 for “Units” option correlated to the button 5810, and a tab 8506 for “Offset” option correlated to the button 5812. When the tab 6302 is chosen (e.g., by pushing the button 5806) from the screen 8500, the interface 5800 directly returns to home and the screen 8500 is replaced with the home screen 5816 shown in FIG. 58. When the tab 6310 is chosen (e.g., by pushing the button 5814) from the screen 8500, the interface 5800 goes back one level and the screen 8500 is replaced with the height screen 8400 shown in FIG. 84.

[00169] When the “Zero” option is chosen (e.g., by pushing the button 5808) from the screen 8500, the screen 8500 is replaced with a height absolute zero screen 8600 shown in FIG. 86. As shown in FIG. 86, the screen 8600 has in its current-screen region 5822 a height icon and a word “Zero”, indicating the current screen 8600 is a height zero screen. Additionally, the screen 8600 has in its settings region 5824 a letter “A”, indicating that the current screen 8600 is a height absolute zero screen. This is further shown by different representations of two new tabs 8602 and 8604 on the screen 8600, where the

tab 8602 representing a height absolute zero option does not have a horizontal line above the word “Absolute”, indicating the height absolute zero option is chosen. Using the buttons 5808 and 5810, a user may toggle between the height absolute zero screen 8500 shown in FIG. 85 and a height relative zero screen (not shown).

[00170] When the “Units” option is chosen (e.g., by pushing the button 5810) from the screen 8500, the screen 8500 is replaced with a default height units screen 8700 shown in FIG. 87. As shown in FIG. 87, the screen 8700 has in its current-screen region 5822 a height icon and a word “Units”, indicating the current screen 8700 is a height units screen. The screen 8700 includes three new tabs 8702 (Frac), 8704 (Dec) and 8706 (mm), which represent a fraction unit option, a decimal unit option, and a metric unit option, respectively. The tab 8702 representing a fraction unit option does not have a horizontal line above “Frac”, indicating the fraction unit option is chosen. As a result of this option, the number in the height value 5846 is displayed in a format of “integer + fraction” (see, e.g., “ $2\frac{1}{16}$ ” in FIG. 87).

[00171] From the screen 8700 shown in FIG. 87, when the button 5810 is pushed, the screen 8700 may be replaced with a height decimal unit screen 8800 shown in FIG. 88. As shown in FIG. 88, the tab 8704 representing a decimal unit option does not have a horizontal line above “Dec”, indicating the decimal unit option is chosen. As a result of this option, the number in the distance value 5838 is displayed in a format of a decimal expansion (see, e.g., “5.<sup>25</sup>” in FIG. 88). Using the buttons 5808, 5810, and 5812, a user may toggle among the default height units (in fraction units) screen 8700 shown in FIG. 87, the height decimal units screen 8800 shown in FIG. 88, and a height metric unit screen (not shown).

[00172] When the “Offset” option is chosen (e.g., by pushing the button 5812) from the screen 8500 shown in FIG. 85, the screen 8500 is replaced with a height offset screen 8900 shown in FIG. 89. As shown in FIG. 89, the screen 8900 has in its current-screen

region 5822 a height icon and a word “Offset”, indicating the current screen 8900 is a height offset screen. Through the screen 8900, a user may add an offset height.

[00173] From the height screen 8400 shown in FIG. 84, when the button 5810 is pushed (and possibly after some other manipulations of the user interface controls 5804), the height screen 8400 may be replaced with a height recall screen 9000 shown in FIG. 90. As shown, the screen 9000 shows in its current-screen region 5822 a height icon and a textual representation “Recall”, indicating to a user that the current screen is for recalling a saved height. There may exist at least one saved height value in a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800. Each saved height value may have a label number such as 1, 2, 3, etc. For example, the screen 9000 shows a value 5846 ( $2\frac{1}{16}$ ) in its settings region 5824. The number “16” to the left of  $2\frac{1}{16}$  indicates that the label number for  $2\frac{1}{16}$  is “16”. The screen 9000 includes two new tabs: a tab 9002 for a “+” option of moving to a saved height value with a higher label number than that shown on the current screen, and a tab 9004 for a “-” option of moving to a saved height value with a lower label number than that shown on the current screen. For example, from the screen 9000 shown in FIG. 90, when the “-” option (the tab 9004) is chosen repeatedly, the screen 9000 may be replaced with a screen 9100 shown in FIG. 91, where a saved height value with a lower label number “5” ( $2\frac{3}{4}$ ) is shown. Additionally, from the screen 9000 shown in FIG. 90, when the “+” option (the tab 9002) is chosen repeatedly, the screen 9000 may be replaced with a screen 9200 shown in FIG. 92, where a saved height value with a higher label number “21” ( $1\frac{1}{64}$ ) is shown.

[00174] From the height screen 8400 shown in FIG. 84, when the button 5812 is pushed, the height screen 8400 may be replaced with a height save screen 9300 shown in FIG. 93. As shown, the screen 9300 shows in its current-screen region 5822 a height icon and a textual representation “Save”, indicating to a user that the current screen is for saving a height value. The screen 9300 includes a “diskette” tab 9302, representing an option of

saving the current value 5846 ( $2 \frac{1}{16}$ ). When the tab 9302 is chosen from the screen 9300, the current value  $2 \frac{1}{16}$  may be given a label number and may be saved into a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800. As mentioned previously, it is contemplated that other removable memory media may be employed with the present invention, such as a DVD, CDR, flash media device, and the like. Therefore, the “diskette” icon may be altered to provide an alternative image more directly reflecting the current memory media being employed. Further, it is understood that the user interface may incorporate the usage of more than one type of memory media and thus include multiple memory media drives.

[00175] FIG. 94 shows another exemplary height save screen 9400, where a current value  $\frac{5}{8}$  is given a label number (“12”) and may be saved into a memory of the user interface 5800 or a memory of the laser measurement and alignment device communicatively coupled to the user interface 5800.

[00176] It is contemplated that an operator of the user interface may input changes to the height settings directly. For example, under the height fine adjustment screen an alternative user input control mode may be included which allows the user to directly affect changes in the height settings. The user may be enabled to make corrections to the height in incremental amounts, such as  $\frac{1}{2}$  inch or  $\frac{1}{4}$  inch, .1” or .01, 5mm or 10mm. The user interface may provide “+” and “-” tabs correlated to user input control buttons which allow for this type of adjustment. The direct change of height setting may be configured in a variety of ways and be within various locations of the height mode as contemplated by one of ordinary skill in the art.

[00177] Referring generally now to FIGS. 95 through 101, various exemplary screens 9500 through 10100 of the display 5802 of the user interface 5800 in a settings mode are shown. Referring to FIG. 95, the settings screen 9500 shows in its current-screen region

5822 a settings icon and a textual representation “Settings”, indicating to a user that the current screen is in a settings mode. As shown, the settings screen 9500 has in its available-option region 5826 five tabs 6302, 9502, 9504, 9506, and 6310 different from the five tabs shown in FIG. 58. The tab 6302 has a “home” icon unfilled with color representing an option of “returning to home directly” and is correlated to the button 5806 directly below. When the button 5806 is pushed, the settings screen 9500 is replaced with the home screen 5816 shown in FIG. 58. The tab 9502 represents an option of “(global) Units” and is correlated to the button 5808 directly below. The tab 9504 represents an option of “Calibration” and is correlated to the button 5810 directly below. The tab 9506 represents an option of “System” and is correlated to the button 5812 directly below. The tab 6310 has a “back arrow” icon representing an option of “back one level” and is correlated to the button 5814 directly below. That is, when the button 5814 is pushed, the interface 5800 goes back one level and the settings screen 9500 may be replaced with the home screen 5816 shown in FIG. 58.

[00178] From the settings screen 9500 shown in FIG. 95, when the “Units” option is chosen (e.g., by pushing the button 5808), the screen 9500 may be replaced with a default global units screen (see, e.g., 9600 shown in FIG. 96). As shown in FIG. 96, the screen 9600 has in its current-screen region 5822 a settings icon and a textual representation “Global Units”, indicating the current screen 9600 is a global units screen. The screen 9600 includes three new tabs 9602 (Frac), 9604 (Dec) and 9606 (mm), which represent a global fraction unit option, a global decimal unit option, and a global metric unit option, respectively, for both a distance value 5838 and a height value 5846. The tab 9602 representing a global fraction unit option does not have a horizontal line above “Frac”, indicating the fraction unit option is chosen. As a result of choosing this option, the number in a distance value 5838 (and/or a height value 5846) is displayed in a format of “integer + fraction” (see, e.g., “ $\frac{1}{16}$ ” for a distance value 5838 in FIG. 96, where the integer is not shown because the integer is zero).

[00179] From the screen 9600 shown in FIG. 96, when the button 5812 is pushed, the screen 9600 may be replaced with a global metric units screen (see, e.g., 9700 shown in FIG. 97). As shown in FIG. 97, the tab 9606 representing a global metric unit option does not have a horizontal line above “mm”, indicating the global metric unit option is chosen. As a result of this option, a distance value 5838 (and/or a height value 5846) is displayed in a metric unit (see, e.g., “1.58 mm” in FIG. 97, where mm is millimeter). Using the buttons 5808, 5810, and 5812, a user may toggle among a default global units (in fraction units) screen (see, e.g., 9600 shown in FIG. 96), a global metric units screen (see, e.g., 9700 shown in FIG. 97), and a global decimal units screen (not shown).

[00180] When the “Calibration” option is chosen (e.g., by pushing the button 5810) from the screen 9500 shown in FIG. 95, the screen 9500 may be replaced with a calibration screen (see, e.g., 5600 shown in FIG. 56, and 5700 shown FIG. 57). Through a calibration screen, a user may perform all kinds of calibrations to a height, an angle, and a distance. Additionally, the user interface 5800 may have a drop-down menu (not shown) on the display 5802 to enable a user to select a calibration parameter from the drop-down menu. For example, a drop-down menu may provide kerf information for various kinds of saw blades, fence orientation information (horizontal or vertical), fence type (Unifense, Biesemeyer fence, or the like). Additionally, a saw blade may have a bar code or a RFID (Radio Frequency Identification) number attached to the saw blade body. When a saw blade is scanned by a bar code scanner or a RFID scanner, as the laser source employed by the present invention may be (shown and described previously in FIGS. 15 through 19), the relevant information (e.g., kerf, and the like) may be automatically entered into the user interface 5800 to enable the user interface 5800 to perform the calibration automatically.

[00181] From the settings screen 9500 shown in FIG. 95, when the “System” option is chosen (e.g., by pushing the button 5812), the screen 9500 may be replaced with a system screen (see, e.g., 9800 shown in FIG. 98). As shown in FIG. 98, the screen 9800 has in

its current-screen region 5822 a settings icon and a textual representation “System”, indicating the current screen 9800 is a system screen. The screen 9800 includes three new tabs 9802, 9804 and 9806, which represent a sound option, a brightness option, and a laser time out option, respectively.

[00182] From the system screen 9800 shown in FIG. 98, when the tab 9802 is chosen (e.g., by pushing the button 5808), the screen 9800 may be replaced with a sound screen (see, e.g., 9900 shown in FIG. 99). As shown in FIG. 99, the screen 9900 has in its current-screen region 5822 a sound icon and a textual representation “Sound”, indicating the current screen 9900 is a sound screen. The screen 9900 includes two new tabs 9902 (“+”) and 9904 (“-”), which represent an option of increasing a sound volume and an option of decreasing a sound volume, respectively. The screen 9900 includes a bar-type scale 9906 showing the current scale of the volume being “5”. By pushing the button 5808 from the screen 9900, the tab 9902 is chosen and the sound volume is increased to a scale larger than “5”. By pushing the button 5810 from the screen 9900, the tab 9904 is chosen and the sound volume is decreased to a scale smaller than “5”. When the scale is decreased to zero (“0”), the sound is turned off.

[00183] The sound feedback mechanism provided by the user interface 5800 presents an audible signal to a user when a tool is in the selected position (e.g., when a saw blade has a desired height or angle, when a fence is in a desired distance from a saw blade, or the like). In a variation of this mechanism, the sound feedback mechanism may emit via a microphone/speaker a series of beeps or other noises to a user that guide the user in the positioning of the tool. For example, the beeps may become louder, more frequent, and/or change in pitch the closer the tool is to the desired position.

[00184] Alternatively, the user interface 5800 may provide visual feedback mechanism (not shown) which presents a visual signal on its display 5802. For example, this visual signal may be as simple as a light or other symbol being displayed on the display 5802

when the tool is in the desired position. In a variation of the visual feedback mechanism, arrows or other visual direction-guiding signals may be presented on the display 5802 to guide the user to the desired position of the tool.

[00185] From the system screen 9800 shown in FIG. 98, when the tab 9804 is chosen (e.g., by pushing the button 5810), the screen 9800 may be replaced with a brightness screen (see, e.g., 10000 shown in FIG. 100). As shown in FIG. 100, the screen 10000 has in its current-screen region 5822 a brightness icon and a textual representation “Brightness”, indicating the current screen 10000 is a brightness screen. The screen 10000 includes two new tabs 10002 (“+”) and 10004 (“-”), which represent an option of increasing screen brightness and an option of decreasing screen brightness, respectively. The screen 10000 includes a bar-type scale 10006 showing the current brightness scale being “8”. By pushing the button 5808 from the screen 10000, the tab 10002 is chosen and the screen brightness is increased to a scale larger than “8”. By pushing the button 5810 from the screen 10000, the tab 10004 is chosen and the screen brightness is decreased to a scale smaller than “8”.

[00186] From the system screen 9800 shown in FIG. 98, when the tab 9806 is chosen (e.g., by pushing the button 5812), the screen 9800 may be replaced with a laser time out screen (see, e.g., 10100 shown in FIG. 101). As shown in FIG. 101, the screen 10100 has in its current-screen region 5822 a laser time out icon and a textual representation “Laser Time Out”, indicating the current screen 10100 is a laser time out screen. The screen 10100 includes two new tabs 10102 (“+”) and 10104 (“-”), which represent an option of increasing a time period for laser time out and an option of decreasing a time period for laser time out, respectively. The screen 10100 includes a bar-type scale 10106 showing three time periods for laser time out: 10 seconds, 30 seconds, and 60 seconds. The current time period for laser time out is shown to be “30 seconds” in FIG. 101. That is, the laser measurement and alignment device will be turned off after it is on for 30 seconds. By pushing the button 5808 from the screen 10100, the tab 10102 is chosen and



the time period for laser time out is increased to “60 seconds”. By pushing the button 5810 from the screen 10100, the tab 10104 is chosen and the time period for laser time out is decreased to “10 seconds”. An alternative embodiment of the bar-type scale 10106 is shown in 10100 of FIG. 62, where the current time period for laser time out is shown to be “10 seconds”, and a user may use the button 5808 to increase this time period and may use the button 5810 to decrease this time period.

[00187] It is understood that the foregoing-described screens shown in FIGS. 55 through 101 are intended as exemplary only and not as a limitation to the present invention. Those of ordinary skill in the art will appreciate that various combinations and arrangements may be employed without departing from the scope and spirit of the present invention.

[00188] Referring, generally, now to FIGS. 102 through 106, table saw assembly 11000, 11100, 11200, 11300, and 11400, are shown. It is contemplated that a laser apparatus 11002, similar to the laser apparatus shown and described in FIGS. 1 through 12, one or more laser light indicia and reading assembly 11102, 11202, and 11204, similar to the laser light indicia and reading assemblies shown and described in FIG. 13 through 24, and a bevel indication assembly, similar to the bevel indication assembly shown and described in FIGS. 8 through 12B, may be operationally coupled to a user interface 11010, 11110, 11210, 11310, and 11410, similar to the user interface shown and described in FIGS. 47 through 101, respectively. FIG. 105 illustrates a first exemplary bevel indication assembly including a laser assembly 11302 communicatively coupled with the user interface 11310. The laser assembly 11302 includes a laser source which emits an incident laser beam 11312, said laser beam 11312 operationally contacting a visual indicator 11314. The laser assembly 11302, in the current embodiment, includes an imaging assembly for providing a visual image which may be displayed on the user interface 11310. FIG. 106 illustrates a second exemplary bevel indication assembly including a sensor assembly 11402. Communicatively coupled with the user interface

11410, the sensor assembly 11402, in the present embodiment, may provide beveled angle information.

[00189] In FIGS. 102 through 106, the exemplary user interfaces are shown enabling the user to conveniently obtain distance, blade height, and beveled angle measurements. The exemplary user interfaces are equipped with multiple selectors, such as the large push buttons, and an operating menu, as outlined in FIGS. 47 through 101. The user interfaces may be positioned at a remote location from the devices it is operationally coupled with, such as on a wall or on a tool belt. The user interfaces may also be positioned on various assemblies, such as a table saw assembly, and the like, with a flexible stand, enabling the user interface to be re-positioned as the user desires.

[00190] It is understood that the various devices may be communicatively coupled with the user interface through a variety of communication assemblies. For instance, a wireless communication assembly may utilize various technologies, such as Bluetooth, radio frequency, infrared, and the like. It is further contemplated that the communicative link may be established utilizing serial cable, optical fiber cable, and the like.

[00191] FIG. 105 illustrates a table saw assembly 11300 including a bevel indication assembly including a laser source 11302 and a visual marker 11314, said laser source is communicatively coupled with a user interface 11310. The laser source 11302 further includes an imaging device 11303, such as a camera, which further communicatively couples with the user interface 11310. In the preferred embodiment, the imaging device 11303 mounts onto the laser source 11302 which is coupled with an adjustable flange 11307. This position may allow the imaging device 11303 to monitor the visual marker 11314. By having the imaging device 11303 communicatively coupled to the user interface 11310, the user can view the visual marker 11314 from an area remote to the table saw assembly 11300. A display screen 11316 is included with the user interface 11310 to show the user a real-time picture of the visual marker 11314. Therefore, when

the laser source 11302 emits a laser beam 11312 onto the visual marker 11314, the imaging device 11303 may relay a picture to the user interface 11310 so that the user may view the visual marker's read-out. This embodiment is advantageous because the user interface 11310 may be positioned in a location remote to the visual marker 11312 such as on a wall, on a different part of the table saw assembly 11300, or on the user's body.

[00192] In alternative embodiments, the establishment of a wireless communication link between the user interface 11310 and the laser source 11302 and the imaging device 11303 may enable these features to be mounted in various positions of the table saw assembly 11300. For example, the laser source 11302, imaging device 11303, and visual marker 11314 may be internally mounted to a cabinet 11305 of the table saw assembly 11300. This may increase the ease of use of the table saw assembly 11300 and may reduce the chances of unwanted contact with the various components of the bevel indication assembly.

[00193] To further explain the embodiment shown in FIG. 106, the sensor assembly 11402 may replace the laser source 11302 and visual marker 11314 of the exemplary bevel indication assembly shown in FIG. 105. The sensor assembly 11402 may consist of a plurality of sensors placed around an adjustment flange 11412. Each sensor may represent a different angular position for the circular saw blade 11408. For instance, one sensor may represent ten degrees while another may represent twenty degrees. As the adjustment flange 11412 rotates with the circular saw blade 11408, the sensor that corresponds to the actual beveled angle, will be activated. Once activated the user interface 11410 recognizes which sensor has sent a signal and displays the corresponding beveled angle, on a display screen 11414. The sensor assembly 11402 may provide the beveled angle without requiring the visual marker 11314 of FIG. 5. It is contemplated that the sensor assembly 11402 may be mounted entirely on the inside of a cabinet 11405 of the table saw assembly 11400, and the user interface 11410 may be positioned so that it is readable from any position.

[00194] It is further contemplated a bevel indication assembly, similar in every respect to the bevel indication assemblies discussed above, may include a laser light indicia and reading assembly. The laser light indicia and reading assembly may be coupled with a user interface through a variety of connecting means such as blue-tooth, fiber optics, hard-wire, or the like. The laser light indicia and reading assembly may provide the user with distance, blade height, and beveled angle measurements.

[00195] It is understood that any combination of the exemplary embodiments listed above may be used in combination with each other without departing from the scope and spirit of the present invention. For instance, the sensor assembly 11402 may be employed by a table saw assembly even in conjunction with features, such as a visual marker.

[00196] Referring now to FIGS. 103 and 104, table saw assembly 11100 and 11200 may employ the laser light indicia and reading assembly 11102 or 11202 and 11204, respectively, and communicatively coupled them with a user interface 11110 and 11210, respectively. So enabled, the table saw assemblies may provide a user, through the user interface, distance, blade height, and beveled angle measurements. As discussed above in reference to FIGS. 102, 105, and 106, the communicative coupling of the laser light and reading assemblies with the user interface may occur through hard wire, blue-tooth, fiber optics, or the like.

[00197] Referring now to FIGS. 107 through 109B, a table saw assembly 11500 includes a table 11502, a circular saw blade 11504, a user interface 11506, and an integrated laser assembly 11510. The user interface 11506 is similar in every respect to those described above in FIGS 47 through 106, and is communicatively coupled with the integrated laser assembly 11510. It is understood that the user interface 11506 may couple with the integrated laser assembly 11510 through various communication assemblies employing

various communication technologies, such as serial cable, blue-tooth, fiber optics, and the like.

[00198] In the preferred embodiment, the integrated laser assembly 11510 composes the throat plate assembly for engaging within the table 11502 and around the circular saw blade 11504. The integrated laser assembly 11510 includes a plurality of laser sources, including lenses, and receivers which encircle the circumference of the slot of the throat plate through which the circular saw blade 11504 extends. In the current embodiment, a first laser source 11511 is operationally disposed adjacent a first receiver 11524, a second laser source 11512 is operationally disposed adjacent a second receiver 11523, a third laser source 11513 is operationally disposed adjacent a third receiver 11522, a fourth laser source 11514 is operationally disposed adjacent a fourth receiver 11521, a fifth laser source 11515 is operationally disposed adjacent a fifth receiver 11520, a sixth laser source 11516 is operationally disposed adjacent a sixth receiver 11519, and a seventh laser source 11517 is operationally disposed adjacent a seventh receiver 11518. The laser sources may emit individual laser beams which may be received by the receivers. It is contemplated, that a single laser source may emit a single laser beam. The plurality of laser sources, described herein, may provide laser light directional arrays and a lens which enables the single laser beam to be split and emit through each lens of the plurality of laser sources.

[00199] By having the plurality of laser sources and receivers disposed within the throat plate, instead of on top of the fence or behind the circular saw blade 11504, the user may be free to move a work piece around his table saw assembly 11500. It is contemplated that the integrated laser assembly may decrease unwanted, incident contact with the plurality of laser sources and receivers. It is also contemplated that the user of a plurality of laser sources may increase the accuracy of the integrated laser assembly 11510, by sending multiple readings to the user interface 11510 for averaging. The integrated laser assembly 11510 may measure blade height and beveled angle.



[00200] FIG. 109 illustrates the table saw assembly 11500 including a fence 11508 coupled with a secondary computing system 11530. The secondary computing system 11530, similar to the computing system 104 described previously, may be communicatively coupled with the user interface 11506. As discussed previously in the instant application, the secondary computing system 11530 may include a laser source for emitting a laser beam. Thus, the secondary computing system 11530 may enable the table saw assembly 11500 with the ability to establish a distance measurement between the fence 11508 and the circular saw blade 11504. Various other functionalities may be accomplished through use of the secondary computing system 11530 of the present embodiment as contemplated by those of ordinary skill in the relevant art.

[00201] FIGS. 110 and 111 illustrate a second exemplary embodiment of a table saw assembly 11600 including a table 11602, a circular saw blade 11604, a user interface 11606, a fence 11608, an integrated laser assembly 11610, and a secondary computing system 11630, similar to that shown and described above in FIG. 109. The user interface 11606 is communicatively coupled with the integrated laser assembly 11610 and the secondary computing system 11630. The communicative coupling may be enabled by various communication assemblies employing various communication technologies, as previously described. The integrated laser assembly 11610, in the preferred embodiment, is a throat plate assembly disposed with a first laser source 11612 operationally disposed adjacent a first receiver 11622, a second laser source 11614 operationally disposed adjacent a second receiver 11620, and a third laser source 11616 operationally disposed adjacent a third receiver 11618. The plurality of laser sources and receivers are disposed adjacent the slot of the throat plate which enables the circular saw blade 11604 to extend above the planar surface of the table 11602.

[00202] In operation, it may be seen that the first, second, third laser sources and the first, second, and third receivers, are enabled to establish a first “extended” position and a

second “recessed” position. The first position extends the laser sources and receivers above the planar surface of the table 11602 in order to establish measurement information, such as blade height and beveled angle. It is further contemplated that the laser sources may extend to the first position independent of the receivers and may be enabled to establish distance measurements to a fence 11608 or other similar device disposed upon the table 11602. The laser sources and receivers, in the second position, may be recessed within the table 11602, thereby maintaining the planar surface of the table 11602 during operation of the circular saw blade 11604.

[00203] It is contemplated that the enabling of the laser sources and receivers into the first and second position may be accomplished in a variety of ways. For example, a worm gear assembly may include a handle which is engaged by the user of the table saw assembly 11600. By rotating the handle in either a clockwise or counter-clockwise direction, the user may determine the position of the laser sources and receivers. Alternatively, the integrated laser assembly 11610 may include various mechanical assemblies which may be in communication with the user interface 11606. Thus, the user of the table saw assembly 11600 may be enabled to enter a command, such as “First Position” or “Second Position”, in the user interface 11606 and have that command transmitted to the mechanical assembly. Then, depending on the command sent, the mechanical assembly may place the laser sources and/or receivers in their first or second position.

[00204] It is understood that the table saw assembly 15000 and 16000 may include various other features and/or may not include various features without departing from the scope and spirit of the present invention.

[00205] A router bit height assembly, employing a laser apparatus is also contemplated by the present invention. As seen in FIGS. 112A and 112B a router table assembly 12000 includes a table 12002, a router 12004, and a router bit height indication assembly 12005.

The router 12004 is mounted, via a plurality of fastener coupling points disposed on the router 12004 and on the table 12002, on the underside of the table 12002. The table 12002 includes a bit extension assembly 12016 which enables a router bit 12006 to extend above the planar surface of the table 12002. The router bit height indication assembly 12005 includes a laser apparatus 12010 which is enabled to emit a laser beam 12012 which operationally engages with a visual marker 12014. The laser apparatus 12010 may be similar to the laser apparatus 100 discussed previously or may be variously configured as contemplated by those of ordinary skill in the relevant art. Further, it is contemplated that the laser apparatus 12010 may be either an integral or non-integral component of the router 12004. The non-integral laser apparatus 12010 may be retro-fitted to a plurality of routers via a universal mounting assembly, such as a strap and metal fastener. It is understood that the mounting assembly includes a variety of fastening as well as latching mechanisms without departing from the scope and spirit of the present invention.

[00206] The laser apparatus 12010 includes a housing 12018 disposed with a laser source 12020. It is understood that the housing 12018 may include a plurality of laser sources in order to meet the needs of a manufacturer or consumer. The laser source 12020 emits the laser beam 12012 which operationally contacts the visual marker 12014. In the preferred embodiment, the visual marker is coupled in a location which provides for its visual ascertainment by an operator of the router table assembly 12000. In FIG. 112A, this is accomplished by coupling the visual marker 12014 with one of the legs which support the table 12002. In FIG. 112B, the visual marker 12014 is coupled to a side of the router table. It is contemplated that additional locations and configurations of the visual marker 12014 may be employed.

[00207] In an exemplary embodiment, the laser source 12020 is enabled to emit an infrared laser beam. This laser beam is invisible to the human eye, however, light emitting diodes may be linked to the laser beam in order to provide a visual indicator of



the travel of the laser beam. In an alternate embodiment, the laser source 12020 may be enabled to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention. Further, it is contemplated that the laser source(s) 12020 employed in the laser apparatus 12010 may include a dithering assembly. A typical dithering assembly in the art includes a laser source and a mirror disposed within a housing and may be employed to establish a laser beam which presents as a continuous line upon a surface.

[00208] Referring to FIG. 113, a perspective view of a second exemplary a router table assembly 12100 including a second exemplary router bit height indication assembly 12105, is provided. In FIG. 113, the router-table assembly 12100 includes a table 12102, a router 12104, and the router bit height indication assembly 12105. The router 12104 is mounted, via a plurality of fastener coupling points disposed on the router 12104 and on the table 12102, on the underside of the table 12102. The table 12102 includes a bit extension assembly 12116 which enables a router bit 12106 to extend above the planar surface of the table 12102. The router bit height indication assembly 12105 includes a laser light indicia and reading assembly 12110 which is enabled to emit a laser beam 12112 which operationally engages with a visual marker 12114. The laser light indicia and reading assembly 12110 may be similar to the laser light indicia and reading assembly discussed previously, in FIGS. 13-24, or may be variously configured as contemplated by those of ordinary skill in the relevant art. Further, it is contemplated that the laser light indicia and reading assembly 12110 may be either an integral or non-integral component of the router 12104. The non-integral laser light indicia and reading assembly 12110 may be retro-fitted to a plurality of routers via a universal mounting assembly, such as a strap and metal fastener. It is understood that the mounting assembly includes a variety of fastening as well as latching mechanisms without departing from the scope and spirit of the present invention.

[00209] The laser light indicia and reading assembly 12110 includes a housing 12118 disposed with a laser source 12120. It is understood that the housing 12118 may include a plurality of laser sources in order to meet the needs of a manufacturer or consumer. The laser source 12120 emits the laser beam 12112 which operationally contacts the visual marker 12114. In the preferred embodiment, the visual marker is coupled in a location which provides for its visual ascertainment by an operator of the router table assembly 12100. In FIG. 113, this is accomplished by coupling the visual marker 12114 with one of the legs which support the table 12102. In alternative embodiments, the visual marker 12114 may be coupled to a side of the router table. It is contemplated that additional locations and configurations of the visual marker 12114 may be employed.

[00210] In an exemplary embodiment, the laser source 12120 is enabled to emit an infrared laser beam. This laser beam is invisible to the human eye, however, light emitting diodes may be linked to the laser beam in order to provide a visual indicator of the travel of the laser beam. In an alternate embodiment, the laser source 12120 may be enabled to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention. Further, it is contemplated that the laser source(s) 12120 employed in the laser light indicia and reading assembly 12110 may include a dithering assembly. A typical dithering assembly in the art includes a laser source and a mirror disposed within a housing and may be employed to establish a laser beam which presents as a continuous line upon a surface.

[00211] A third exemplary router table assembly 12300 is shown in FIG. 114. The router table assembly 12300 includes a table 12302, a router 12304, the router bit height indication assembly 12305, and a user interface 12330, similar to the user interface described above in reference to FIGS. 47 through 111. The router 12304 is mounted, via a plurality of fastener coupling points disposed on the router 12304 and on the table 12302, on the underside of the table 12302. The table 12302 includes a bit extension assembly 12316 which enables a router bit 12306 to extend above the planar surface of

the table 12302. The user interface 12330 is communicatively coupled with the router bit height indication assembly 12305. As described previously, the communicative link may be established employing a variety of communication technologies. In the preferred embodiment, the communicative link is a wireless communicative coupling.

[00212] The router bit height indication assembly 12305 includes a laser light indicia and reading assembly 12310 disposed with a laser source 12320 which is enabled to emit a laser beam 12312 which operationally engages with a visual marker 12314. Additionally, the router bit height indication assembly 12305 includes an imaging device 12324. In the preferred embodiment, the imaging device 12324 mounts onto the laser light indicia and reading assembly 12310 and is communicatively coupled with the laser light indicia and reading assembly 12310 via a cable 12326. It is understood that the communicative coupling of the imaging device 12324 and the laser light indicia and reading assembly 12310 may be accomplished in a variety of manners. For instance, the coupling may be a wireless coupling. Further, the communication technologies employed may vary as contemplated and described previously and by those of ordinary skill in the art. This position may allow the imaging device 12324 to monitor the visual marker 12314. By having the imaging device 12324 communicatively coupled to the user interface 12330, the user can view the visual marker 12314 from an area remote to the table saw assembly 12300. A display screen 12332 is included with the user interface 12330 and is enabled to show the user a real-time picture of the visual marker 12314. Therefore, when the laser source 12320 emits a laser beam 12312 onto the visual marker 12314, the imaging device 12324 may relay a picture to the user interface 12330 so that the user may view the visual marker's read-out. This embodiment is advantageous because the user interface 12330 may be positioned in a location remote to the visual marker 12314 such as on a wall, on a different part of the table saw assembly 12300, or on the user's body.

[00213] The laser light indicia and reading assembly 12310 may be similar to the laser light indicia and reading assembly discussed previously, in FIGS. 13-24 and 113, or may

be variously configured as contemplated by those of ordinary skill in the relevant art. Further, it is contemplated that the laser light indicia and reading assembly 12310 may be either an integral or non-integral component of the router 12304. The non-integral laser light indicia and reading assembly 12310 may be retro-fitted to a plurality of routers via a universal mounting assembly, such as a strap and metal fastener. It is understood that the mounting assembly includes a variety of fastening as well as latching mechanisms without departing from the scope and spirit of the present invention.

[00214] The laser light indicia and reading assembly 12310 includes a housing 12318 disposed with the laser source 12320. It is understood that the housing 12318 may include a plurality of laser sources in order to meet the needs of a manufacturer or consumer. The laser source 12320 emits the laser beam 12312 which operationally contacts the visual marker 12314. In the preferred embodiment, the visual marker is coupled in a location which provides for its visual ascertainment by the imaging device 12324 of the router table assembly 12300. In FIG. 114, this is accomplished by coupling the visual marker 12314 with one of the legs which support the table 12302. In alternative embodiments, the visual marker 12314 may be coupled to a side of the router table. It is contemplated that additional locations and configurations of the visual marker 12314 may be employed.

[00215] In an exemplary embodiment, the laser source 12320 is enabled to emit an infrared laser beam. This laser beam is invisible to the human eye, however, light emitting diodes may be linked to the laser beam in order to provide a visual indicator of the travel of the laser beam. In an alternate embodiment, the laser source 12320 may be enabled to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention. Further, it is contemplated that the laser source(s) 12320 employed in the laser light indicia and reading assembly 1230 may include a dithering assembly. A typical dithering assembly

in the art includes a laser source and a mirror disposed within a housing and may be employed to establish a laser beam which presents as a continuous line upon a surface.

[00216] The above router table assembly 12000, 12100, and 12300 establish a visual indication of the bit height relative to the table. This may be advantageous for a number of reasons, including the establishment of precise and accurate cuts. In operation, the above router table assemblies provide a laser beam which tracks along a visual marker, thereby providing the indication of bit height. The laser apparatus are coupled with the routers and thusly move as the router is moved. For example, the user of the router table assembly may adjust the height of the router through a mechanical connection with a router depth adjustment assembly or the like. As the user adjusts the router, the laser apparatus is adjusted and therefore, the position which the laser beam strikes the visual marker is adjusted.

[00217] It is contemplated that various laser apparatus may be employed with the present invention. The exemplary embodiments illustrated in the present figures are not intended to be exhaustive of the laser apparatus available for use with the present invention. Further, a greater number of laser beam sources may be employed in order to meet the needs of a manufacturer or consumer.

[00218] Referring to FIG. 115, an isometric illustration of a fourth exemplary embodiment of a router table assembly 12400, is shown. The router table assembly 12400 includes a table 12402, a router 12404, and a router bit height indication assembly 12405. The router 12404 is mounted, via a plurality of fastener coupling points disposed on the router 12404 and on the table 12402, on the underside of the table 12402. The table 12402 includes a bit extension assembly 12416 which enables a router bit 12406 to extend above the planar surface of the table 12402. A user interface 12430 is communicatively coupled with the router bit height indication assembly 12405. As described previously, the communicative link may be established employing a variety of

communication technologies. In the preferred embodiment, the communicative link is a wireless communicative coupling.

[00219] The router bit height indication assembly 12405 includes a laser apparatus 12410 which is enabled to emit a laser beam 12412 which operationally engages with a sensor assembly 12414 including a receiver assembly 12415. The laser apparatus 12410 may be similar to the laser apparatus 100 discussed previously or may be variously configured as contemplated by those of ordinary skill in the relevant art. Further, it is contemplated that the laser apparatus 12410 may be either an integral or non-integral component of the router 12404. The non-integral laser apparatus 12410 may be retro-fitted to a plurality of routers via a universal mounting assembly, such as a strap and metal fastener. It is understood that the mounting assembly includes a variety of fastening as well as latching mechanisms without departing from the scope and spirit of the present invention.

[00220] The laser apparatus 12410 includes a housing 12418 disposed with a laser source 12420. It is understood that the housing 12418 may include a plurality of laser sources in order to meet the needs of a manufacturer or consumer. The laser source 12420 emits the laser beam 12412 which operationally contacts the receiver assembly 12415. In the preferred embodiment, the sensor assembly 12414 is coupled in a location which provides for the operational engagement by the laser beam 12412 with the receiver assembly 12415. In FIG. 115, this is accomplished by coupling the sensor assembly 12414 with one of the legs which support the table 12402. In alternative embodiments, the sensor assembly 12414 may be coupled to a side of the router table. It is contemplated that additional locations and configurations of the sensor assembly 12414 may be employed.

[00221] In an exemplary embodiment, the laser source 12420 is enabled to emit an infrared laser beam. This laser beam is invisible to the human eye, however, light emitting diodes may be linked to the laser beam in order to provide a visual indicator of

the travel of the laser beam. In an alternate embodiment, the laser source 12420 may be enabled to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention. Further, it is contemplated that the laser source(s) 12420 employed in the laser apparatus 12410 may include a dithering assembly. A typical dithering assembly in the art includes a laser source and a mirror disposed within a housing and may be employed to establish a laser beam which presents as a continuous line upon a surface.

[00222] The sensor assembly 12414 includes a housing 12417 which at least partially encompasses the receiver assembly 12415. In the preferred embodiment, the receiver assembly 12415 is a slotted assembly disposed within the housing 12417. Further, the receiver assembly 12415 provides a surface upon which the laser beam 12412 may strike. A series of hash marks may be disposed along a side of the slotted assembly to provide visual indication of router bit height for a user of the router table assembly 12400. The receiver assembly 12415 is enabled to receive the laser beam 12412 and determine the router bit height based on the location the laser beam 12412 strikes the receiver assembly 12415. Thus, at least partially disposed within the housing 12417 of the sensor assembly 12414 is a computing system enabled to process the received laser beam 12412 and determine the measurement of the router bit height.

[00223] In the preferred embodiment, the sensor assembly 12414, particularly the computing system disposed within the housing 12417, is communicatively coupled with the user interface 12430. Thus, the user interface 12430 is provided the information relating to the router bit height as established by the sensor assembly 12414. In an alternative embodiment, the user interface 12430 may perform the necessary processing of the information received from the laser beam 12412 striking the receiver assembly 12415. Thus, the receiver assembly 12415 may be enabled as a conduit of information between the laser beam 12412 and the user interface 12430.

[00224] A display screen 12432 is included with the user interface 12430 and is enabled to show the user a real-time picture of the information received from the sensor assembly 12414. Therefore, when the laser source 12420 emits a laser beam 12412 onto the receiver assembly 12415, the display screen 12432 may display a reading so that the user may view the sensor assembly 12414 or user interface 12430 read-out. This embodiment is advantageous because the user interface 12430 may be positioned in a location remote to the sensor assembly 12414 such as on a wall, on a different part of the table saw assembly 12400, or on the user's body.

[00225] Referring to FIGS. 116A and 116B, an isometric illustration of a router table assembly 12500 including a table 12502, a router 12504 with a bit 12506 extending through an extension assembly 12508 disposed within the table 12502, and a router bit height indication assembly 12510. The router bit height indication assembly including a first housing 12512 and a second housing 12514. In the preferred embodiment, the first and second housing component 12512 and 12514 are communicatively coupled to a user interface 12530 including a display screen 12532.

[00226] The first and second housing component 12512 and 12514 are preferably coupled with the table 12502 via fastening assemblies. The first housing component 12512 is coupled with the table 12502 by a first fastening assembly 12522 while the second housing 12514 is coupled with the table 12502 by a second fastening assembly 12524. In the preferred embodiment, the first and second fastening assemblies are wing nut assemblies which enable an operator to secure and remove the first and second housings from the table 12512. Further, the fastening assemblies enable the user to affix the position of the first and second housing 12512 and 12514 in various locations about the table 12502.

[00227] In the current embodiment, the first housing 12512 is disposed with a laser assembly 12516 which includes a laser source and lens for emitting a laser beam 12520.



The second housing 12514 includes a receiver assembly 12518 which includes a lens and a computing system. It is contemplated that the computing system may be enabled to determine the router bit height based on the receiving of the laser beam 12520. However, in the preferred embodiment, the receiving assembly 12518 communicates information to the user interface 12530 where it is processed and displayed for the user to see. It is understood that the communicative coupling of the user interface 12530 with the first and second housing 12512 and 12514 of the router bit height indication assembly 12510 is established as a wireless communication link, in the preferred embodiment. Alternatively, the communication link may be established using various communication technologies without departing from the scope and spirit of the present invention. For instance, a wireless communication assembly may utilize various technologies, such as Bluetooth, radio frequency, infrared, and the like. It is further contemplated that the communicative link may be established utilizing serial cable, optical fiber cable, and the like.

[00228] In an exemplary embodiment, the laser source is enabled to emit an infrared laser beam. This laser beam is invisible to the human eye, however, light emitting diodes may be linked to the laser beam in order to provide a visual indicator of the travel of the laser beam. In an alternate embodiment, the laser source may be enabled to emit various types of laser beams, such as an ultraviolet laser beam, or the like without departing from the scope and spirit of the present invention. Further, it is contemplated that the laser source(s) employed may include a dithering assembly. A typical dithering assembly in the art includes a laser source and a mirror disposed within a housing and may be employed to establish a laser beam which presents as a continuous line upon a surface.

[00229] It is understood that the first and second housing 12512 and 12514 of the router bit height indication assembly 12510 may be positioned in various locations. However, the positioning of the housings enables the functionality of the router bit height indication

assembly 12510. Thus, the housings may be established in various locations so long as the laser beam 12520 is enabled to be established between the two housings.

[00230] Referring to FIGS. 117A and 117B, an isometric illustration of a router table assembly 12600, is shown. The router table assembly 12600 includes a table 12602, a router 12604 with a bit 12606 extending through an extension assembly 12608 disposed within the table 12502, and a router bit height indication assembly 12610. The router bit height indication assembly including a first housing 12612 and a second housing 12614. In the preferred embodiment, the first and second housing component 12612 and 12614 are communicatively coupled to a user interface 12630 including a display screen 12632.

[00231] The first and second housing component 12612 and 12614 are preferably coupled with the table 12602 via fastening assemblies, similar to those shown and described in FIGS. 116A and 116B. Thus, the first and second housings may be secured to in various locations about the table 12602.

[00232] In the current embodiment, the first housing 12612 is disposed with a laser assembly 12616 which includes a laser source and lens for emitting a first laser beam 12620, a second laser beam 12622, and a third laser beam 12624. The second housing 12614 includes a receiver assembly 12618 which includes a lens and a computing system. It is contemplated that the computing system may be enabled to determine the router bit height based on the receiving of the laser beams. However, in the preferred embodiment, the receiving assembly 12618 communicates information to the user interface 12630 where it is processed and displayed for the user to see.

[00233] The user interface 12630 is mounted upon a docking station 12634 which is coupled with the first housing 12612. The docking station 12634 includes an adapter 12636 which couples with the user interface 12630. The adapter 12636 further establishes a communicative link with the first housing 12612 and may establish a

communicative link with the second housing 12614. It is understood that the communicative coupling of the user interface 12630 and/or the adapter 12636 with the first and second housing 12612 and 12614 of the router bit height indication assembly 12610 is established as a wireless communication link, in the preferred embodiment. Alternatively, the communication link may be established using various communication technologies without departing from the scope and spirit of the present invention. For instance, a wireless communication assembly may utilize various technologies, such as Bluetooth, radio frequency, infrared, and the like. It is further contemplated that the communicative link may be established utilizing serial cable, optical fiber cable, and the like.

[00234] In an exemplary embodiment, the laser source is enabled to emit a plurality of infrared laser beams. The plurality of laser beams are invisible to the human eye, however, light emitting diodes may be linked to the laser beams in order to provide a visual indicator of the travel of the laser beams. In an alternate embodiment, the laser source may be enabled to emit various types of laser beams, such as an ultraviolet laser beams, or the like without departing from the scope and spirit of the present invention. Further, it is contemplated that the laser source(s) employed may include a dithering assembly. A typical dithering assembly in the art includes a laser source and a mirror disposed within a housing and may be employed to establish a laser beam which presents as a continuous line upon a surface.

[00235] It is understood that the first and second housing 12612 and 12614 of the router bit height indication assembly 12610 may be positioned in various locations. However, the positioning of the housings enables the functionality of the router bit height indication assembly 12610. Thus, the housings may be established in various locations so long as the laser beams are enabled to be established between the two housings.

[00236] The fastening assemblies which secure the first and second housings to the table of the router assemblies in FIGS. 116 and 117, may be enabled with the ability to rotate the housings outside of the working plane of the table, thereby allowing the user access to the entire operational field of the router table. In alternative embodiments, the fastening assemblies may be removed from the table. It is understood that the number, location, and configuration of the housings and fastening assemblies may vary as contemplated by one of ordinary skill in the art.

[00237] Referring to FIGS. 118 and 119, an isometric illustration of an integrated laser router table assembly 12700, is shown. The router table assembly 12700 includes a table 12702, a router 12704 with a bit 12706 extending through a router mounting assembly 12708 disposed within the table 12702. The router mounting assembly 12708 includes multiple fastening points through which fasteners may engage with the router 12704. Additionally, the router mounting assembly 12708 establishes an aperture through which the router bit 12706 extends through the table 12702. Disposed in the table 12702 is an integrated laser assembly 12709 comprising a laser assembly 12710 and a receiver assembly 12712. In the preferred embodiment, the laser assembly 12710 and receiver assembly 12712 are disposed about the circumference of the aperture defined by the router mounting assembly 12708. The laser assembly 12710 includes a laser source, which emits a laser beam 12716. The receiver assembly 12712, disposed on the opposite side of the aperture from the laser assembly 12710, is operationally engaged by the laser beam 12716. The integrated laser assembly 12709 is communicatively coupled with a user interface 12720 including a display screen 12722. The user interface 12720 is similar to the user interfaces described previously in FIGS. 47 through 117. In the preferred embodiment, the integrated laser assembly 12709 is in communication with the user interface 12720 via a wireless connection. It is contemplated that alternative means of establishing communication between the integrated laser assembly 12709 and the user interface 12720 (i.e. hard-wired, fiber optics, blue tooth, and the like) may be employed without departing from the scope and spirit of the present invention.

[00238] The user interface 12720 may be coupled with the router table assembly 12700 in a variety of ways. For example, the user interface 12720 may be coupled with a mounting assembly which couples with the table 12702. Alternatively, the user interface 12720 may operationally couple with a docking station mounted to the table 12702. As shown in FIG. 119, it is contemplated that the user interface 12720 may be remotely located from the router table assembly 12700 and maintain the communication link with the integrated laser assembly 12709.

[00239] A second exemplary embodiment of the integrated laser router table assembly 12800 is provided in FIG. 120. In the current embodiment, the integrated laser router table assembly 12800 includes a router 12804 with a bit 12806 extending through a router mounting assembly 12808 disposed within the table 12802. The router mounting assembly 12808 includes multiple fastening points through which fasteners may engage with the router 12804. Additionally, the router mounting assembly 12808 establishes an aperture through which the router bit 12806 extends through the table 12802. Disposed in the table 12802 is an integrated laser assembly 12809 comprising a plurality of laser sources 12810, 12812, 12814, and 12816 which emit a plurality of laser beams through a plurality of lenses. The plurality of laser beams are received by a plurality of receiver assemblies 12818, 12820, 12822, and 12824. The plurality of laser sources and receiver assemblies are positioned around the router receiving aperture. The integrated laser assembly 12809 is in communication with a user interface 12820 which is similar to the user interface described in FIGS. 47 through 119.

[00240] Router bit height is determined by the integrated laser router table assembly 12800 which is relayed to the user interface 12820 which in turn displays the router bit height reading to the user on a display screen 12822. The integrated laser assembly 12809 is in communication with the user interface 12820 via a wireless connection. However, it is understood that alternative means of establishing communication between the integrated

laser assembly 12809 and the user interface 12820 (i.e. hard-wired, fiber optics, blue tooth, and the like) may be employed without departing from the scope and spirit of the present invention.

[00241] Referring now to FIGS. 121 through 126 a laser level apparatus 13000 is shown. The laser level apparatus 13000 includes a housing 13002 with a first end 13003 and a second end 13005. In the preferred embodiment, disposed proximal to the second end 13005 and internally within the housing 13002 is a laser assembly 13004. The laser assembly 13004 includes a housing 13006, which is disposed with a laser source 13008. Coupled with the housing 13006 and the laser source 13008 is a selector assembly 13010. The selector assembly 13010 enables a user of the laser level apparatus 13000 to determine the functioning of the laser assembly 13004. The selector assembly 13010 may be a two position assembly, a first “on” position and a second “off” position, may be selected. When in the first position, the laser source 13008 is enabled to emit a laser beam 13012. The laser beam 13012 travels down the length of the housing 13002 via a laser beam channel 13013. Disposed proximal to the first end 13003 and internally within the housing 13003 is an optical assembly 13014. In the present embodiment, the optical assembly 13014 is an optical splitter, which is enabled to divide the laser beam 13012. Thus, when the laser beam 13012 strikes the optical assembly 13014 it is split and sent to separate lenses. A first lens 13016, a second lens 13018, a third lens 13020, and a fourth lens (not shown) receive and emit out of the housing 13002 an incident laser beam.

[00242] In the preferred embodiment, the laser level apparatus 13000 may be used to establish multiple axis of measurement. This may enable a user to determine multiple points of operation relative to a single identified location using the laser level apparatus 13000. The laser level apparatus 13000 further includes a first leveling indicator assembly 13022 and a second leveling indicator assembly 13024. These leveling

assemblies provide relevant indication of the positioning of the housing 13002 relative to the horizontal and vertical axis of the laser level apparatus 13000.

[00243] The laser level apparatus 13000 includes a plurality of mounting assemblies 13030, 13032, 13034, and 13036, as shown in FIG. 125. These mounting assemblies may enable the laser level apparatus 13000 to be mounted on a variety of surfaces and/or objects. For instance, the laser level apparatus 13000 may be mounted to a fence of a table saw assembly, such as the mounting of the laser apparatus 100. In the preferred embodiment, the mounting assemblies comprise threaded bores in the housing 13002 which may be engaged by various fasteners, such as screws and bolts. It is contemplated that the functionality of the mounting assemblies may be enabled utilizing various mounting assemblies, such as a compression assembly, latch assembly, spring-loaded assembly, and the like.

[00244] A second exemplary embodiment of a laser level apparatus 13100 is illustrated in FIGS. 127 and 128. The laser level apparatus 13100 is similar in every respect to the laser level apparatus 13000, except that the laser level apparatus 13100 includes a third leveling indicator assembly 13140 including an indicator 13142 and an angular identifier 13144. The indicator 13142, in the preferred embodiment, establishes an angular position of the laser level apparatus 13000 by corresponding its location with an angle displayed on the angular identifier 13144. It is understood that various configurations of the third leveling indicator assembly 13140 may be employed without departing from the scope and spirit of the present invention.

[00245] Referring now to FIGS. 129 through 142, an exemplary user interface 13500 enabled to provide access to a plurality of user selectable modes which may further enable various user selectable functionalities, is shown. The user interface 13500 is similar to the user interface shown and described above in FIGS. 47 through 101. The user interface 13500 includes a housing 13502 and a display 13504. In the present

embodiment, the display 13504 is configured in a dual-cell screen mode with a first cell/sub-cell display region 13542 and a second cell/sub-cell display region 13544. It is contemplated that alternative configurations of the display 13504 may be employed, for instance a single-cell screen mode and a tri-cell screen mode which establish one or more cells and sub-cells within the display, as will be discussed below.

[00246] Disposed upon both the housing 13502 and the display 13504 is a plurality of user input controls, which are generally indicated at 13506, 13520, 13540, 13550, and 13560. The display 13504 may be LCD (liquid crystal display), a pixel-based display, or the like. As shown, the user input controls include a selector assembly 13506 which, in the preferred embodiment, includes a plurality of push (or enter) buttons 13508, 13510, 13512, 13514, and 13516. The buttons 13508 through 13516 enable a user to select or toggle between the screens and modes displayable on the display 13504, and to select input values for any of the available options, as discussed in more detail subsequently. In FIGS. 129 through 142, the buttons 13508 through 13516 are positioned at the bottom of the housing 13502 and correlate with an option on the display 13504 available for selection by the user. However, the buttons 13508 through 13516 may be positioned anywhere on the housing 13502 of the user interface 13500 as may be contemplated by a person of ordinary skill in the art. In the exemplary embodiment shown, the buttons 13508 through 13516 are all enter buttons. However, it is within the scope of the present invention that other configurations and numbers of buttons may be used. Similarly, other forms of user input controls may be used, such as slides, track balls, switches, and pointing devices. Of course, although the described user interface is relatively large and complex, it is also possible to provide a much smaller user interface with less information displayed at a time.

[00247] As previously described, FIG. 56 illustrates a default, or “Calibrating” screen of the display 5802. It is contemplated that this screen may be the initial display provided to a user and from which the user accesses the various functional capabilities of the user



interface 5800 and 13500. Access to the various modal functionalities to be described below in reference to FIGS. 129 through 142, may be made from this initial display and user input controls. For example, a user may access the modal functionalities of the user interface 13500 by “pushing” the button 5814 which accesses the modal “Settings” screen which may provide various alternative modal options, which are displayed on the screen. Under the “Settings” screen, the user may be further enabled to select various secondary modal options which may enable the display 13504 with various secondary screens which display information (i.e., various secondary modal functionalities) which will be described below in reference to FIGS. 129 through 142. It is understood that the default “Calibration” screen may be the screen to which the user interface 5800 and 13500, defaults after the user inputs are completed on any of the subsequently described screens. It is further contemplated that various other screens, such as the “Settings” screen, may be the default screen after user inputs without departing from the scope and spirit of the present invention.

[00248] The display 13504 (and hence each screen of the display 13504) may include a battery region and a developer region as described previously for the user interface 5800.

[00249] The battery region, which may be a sub-cell of the display screen or a designated exclusive region of the display screen, may provide a user with information about the status of batteries used to provide power to the user interface 13500. It is contemplated that the battery region may be configured to provide power information relating to the status of various devices, such as the laser apparatus 100, laser light indicia and reading assemblies described throughout the present disclosure, and the various other laser assemblies described throughout the present disclosure, with which the user interface 13500 may be communicatively coupled. This feature is useful to allow a user to monitor the status of the battery during use. In particular, a user may want to check the remaining battery capacity before starting a project that may require more battery reserve than currently available. It is understood that the battery region and textual/graphic display

representation may be positioned on the display 13504 as may be contemplated by a person of ordinary skill in the art.

[00250] The developer region, which may be a sub-cell of the display screen or a designated exclusive region of the display screen, may provide information about the developer of the user interface 13500. Alternatively, the developer region may be not included in the display 13504. In another embodiment the developer region may provide an indication of ownership of the individual user interface. For example, a user may place a specific logo in this region to identify the user interface 13500 as their own. It is understood that the location of the developer region on the display 13504 may vary. Further, each user interface may be enabled with a security feature which allows the individual unit to be protected from unauthorized use by another. For example, the security feature may include a user being able to enter a password into the user interface 13500 which is required before operation of the user interface will be allowed. It is contemplated that other security features may be incorporated into the present invention as contemplated by one of ordinary skill in the art.

[00251] The display 13504 (and hence each screen of the display 13504) may include a variety of cells and/or sub-cells, within a single, dual, or tri-screen mode, providing numerous capabilities, for example an available-option region 13520, a current-screen region 13540, a descriptive identifier region 13550, a settings region 13560, and a mode icon region 13570. For each screen of the display 13504 of the interface 13500, the available-option region 13520 includes a plurality of tabs used to show available options a user may have from the current screen. Each of the tabs may use an icon, textual, and/or graphic representation to indicate an option available from the current screen. The tabs may be established in a designated region or within a cell or sub-cell of the various screen modes which may be established upon the graphical user interface of the present invention. Each of the tabs is correlated to a user input control (e.g., a button, touch pad, and the like). To choose an option representing a tab, a corresponding user input control

may be operated on (e.g., a corresponding button is pushed, or the like). In the preferred embodiment, each tab is correlated to a button directly below. This correlation of location, establishing a user input control in direct physical proximity to the tab, provides an ease of use of the present invention generally not seen in the art.

[00252] The current-screen region 13540 is used to show the screen status of the user interface 13500. It is contemplated that the available options region 13520 and other regions described below may be incorporated, such as through the establishment of sub-cells, into the current-screen region 13540. The descriptive identifier region 13550 displays the various current operating modes made available by the user interface 13500 to the user. For example, the descriptive identifier region 13550 identifies “SCREEN” as the current operational mode of the user interface 13500 in FIG. 129. It is further contemplated that the descriptive identifier region 13550 may be enabled as a first display descriptive identifier region 13552 and a second display descriptive identifier region 13554 and may display other relevant information, such as “Distance” and “Height” as shown in FIG. 134. Various other configurations as contemplated by those of skill in the art may be enabled in the descriptive identifier region(s). In the preferred embodiment, the descriptive identifier region 13550 is a separate region (cell and/or sub-cell) of the display 13504.

[00253] The settings region 13560 displays information to the user about the current setup of programmed and user-selected modes for the tool (e.g., a table saw, or the like). As shown in FIGS. 130, 134-138, and 140-142 the settings region (settings cell/sub-cell) 13560 may be disposed in the first (cell/sub-cell) display region 13542, the second (cell/sub-cell) display region 13544, or both the first and second cell/sub-cell display regions at the same time. Further, the settings region 13560 may include a first display settings region 13562 and a second display settings region 13564. The first and second display settings regions may partially encompass the first and/or second cell/sub-cell display region 13542 and 13544. However, the first and second display settings regions

may encompass the entire first and/or second display region 13542 and 13544, as shown in FIGS. 137, 138, 141, and 142. As illustrated in FIGS. 137, 138, 141 and 142, the first and second cell/sub-cell display regions may be further delimited by one or more sub-sub-cell regions 13565, 13566, and 13567; within which various types of information may be displayed in the settings region without departing from the scope and spirit of the present invention. It is understood that the configuration, including the number and size of cell, sub-cell, and/or sub-sub-cell regions, may vary to accommodate varying display 13504 configurations.

[00254] Referring now to FIGS. 134, 136, 138, 140, and 142, the display 13504 of the user interface 13500 may be enabled to establish various settings in the settings region 13560. For example, FIG. 134, shows the user interface 13500 enabled in a dual-cell screen mode displaying distance and height information. The first cell/sub-cell display settings region 13562 provides information related to the distance measurement while the second cell/sub-cell display settings region 13564 provides information related to the height measurement. Other dual-cell screen mode displays may be enabled as shown in the figures identified above and contemplated by those of ordinary skill in the art.

[00255] It is further contemplated that the settings region 13560 may be enabled to provide user selectable inputs. As illustrated in FIG. 135, the first and second cell/sub-cell display settings regions include an identification of the angle of the blade, as presented, and enable a user to select "Y" if the angle is correct or "N" if the angle is incorrect. Additionally, the box provided in the second cell/sub-cell display settings region 13564, next to the "N", may be enabled to display multiple options for consideration and selection by the user. For example, if the user selects "N" then the box region may display a numerical angular representation, such as that shown in box next to the "Y" in the first cell/sub-cell display settings region 13562. The user may be enabled, through use of the buttons of the selector assembly 13506, to adjust the numerical angular representation in the box of the second cell/sub-cell display settings region 13564 to a

preferred value and then have that value established by the tool to which the user interface 13500 is coupled.

[00256] The mode icon region 13570 may provide a textual and/or graphic representation of various modal functionalities enabled by the user interface 13500. In the preferred embodiments, the modal functionalities include “distance”, “height”, “angle”, “bevel”, and “diameter”. For example, in FIG. 130, the mode icon region establishes a first exemplary icon for distance, while in FIG. 134 a second exemplary icon for distance is shown. It is contemplated that other modal functionalities may be enabled by the present invention as contemplated by those of ordinary skill in the relevant art. It is further contemplated that the mode icon region 13570 may include a first cell/sub-cell display mode icon region 13572 and a second cell/sub-cell display mode icon region 13574. It is understood that the configuration, including the number and size of cell/sub-cell mode icon regions, may vary to accommodate varying display 13504 configurations.

[00257] Referring now to FIG. 129, the user interface 13500 is operationally enabled in the “SCREEN” mode, as identified by the descriptive identifier region 13550. In this mode the user is enabled to select the configuration of the display 13504. The available options region 13520 presents the user with five tabs to select from. A first tab 13522 presents an iconic “home” option, a second tab 13524 presents a first screen configuration option, a third tab 13526 presents a second screen configuration option, a fourth tab 13528 presents a third screen configuration option, and a fifth tab presents a “forward arrow” option. The five tabs are operationally coupled with the five push buttons 13508 through 13516, of the selector assembly 13506, respectively. Thus, a user may select one of the five options presented on the five tabs by pushing the corresponding button which is located directly under the tab.

[00258] It is understood that the first tab 13522 may be configured for the “home” option, as shown throughout the FIGS. 129 through 142, or the first tab 13522 may be alternately

configured. The “home” option of the first tab 13522, if selected by the user, instructs the user interface 13500 to display the home screen. The home screen may be the “Calibration” screen described previously or various other screens which may be determined by those of ordinary skill in the art. It is contemplated that the first tab 13522 which is labeled with the “home” icon may be filled with a color different from the background, indicating the current screen is the home screen. Moreover, the first tab 13522 may be marked differently when the user interface is displaying the home screen, for instance the first tab 13522 may include a horizontal line above the “home” icon to indicate that the current screen is the home screen. Thus, the button 13508, when pushed, instructs the user interface 13500 to display the home screen as correlated with the “home” option identified on the first tab 13522.

[00259] In the present embodiment, the second tab 13524 presents a single-cell screen mode option. Thus, if the user pushed the second button 13510, which is correlated with the second tab 13524, while in this screen mode, the display 13504 is configured as a single-cell screen and presents the information in accordance with this display configuration. If the user pushed the third button 13512, which is correlated with the third tab 13526, the display 13504 is configured as a split screen or dual-cell screen. In the present embodiment, the third tab 13526 does not have a horizontal line above it representing that this is the currently displayed configuration. The split screen configuration is shown in FIGS. 129 through 142. If the user selects the fourth button 13514, which is correlated with the tab 13528, the display 13504 is configured to provide three separate displays of information, as shown and described in FIGS. 47 through 101. The fifth button 13516 correlates with a “forward arrow” icon displayed in the fifth tab 13530. The selection of the “forward arrow” results in the user interface 13500 moving out of the “SCREEN” mode and to another mode, such as those previously described or those described below. It is contemplated that selection of one of the buttons, other than the fifth button, may enable the user interface 13500 to move out of the “SCREEN” mode and into an alternative mode. Further, a selection made in the “SCREEN” mode may

enable the user interface 13500 to display a specific screen, such as the “home” screen, from which further operations may be performed.

[00260] When enabled in the “Units” mode the display 13504 may provide a default distance units screen, as shown in FIG. 130. As shown in FIG. 130, the screen has in the mode icon region 13570 a distance icon and “Units” is displayed in the descriptive identifier region 13550, indicating the current screen is a distance units screen. Four of the tabs of the available options region 13520 are reconfigured to display “Units” options on the display 13504 when in the “Units” mode. The second tab 13524 includes a “Frac” which represents a fraction unit option, the third tab 13526 includes a “Dec” which represents a decimal unit option, and the fourth tab 13528 includes an “mm” which represents a metric unit option. Further, the fifth tab has a “back arrow” icon representing an option of “back one level” and is correlated to the button 13516 directly below. That is, when the button 13516 is pushed, the interface 13500 goes back one level. The screen displayed, after selecting to go back one level, may depend on where in the hierarchy of screens (see FIG. 55) the “Units” mode screen, as displayed, is located.

[00261] The tab 13524 representing a fraction unit option does not have a horizontal line above “Frac”, indicating the fraction unit option is chosen. As a result of this option, the number in the first display settings region 13562, which represents a distance value is displayed in a format of “integer + fraction” (see, e.g., “5¼” in FIG. 130). If the third or fourth tabs were selected then the display of units may be altered to provide information in a decimal format or a metric format, respectively.

[00262] FIG. 131 illustrates the user interface 13500 enabled in a “Laser” mode, as identified in the descriptive identifier region 13550. In the “Laser” mode the first display region 13542 establishes a laser picture 13580 representation of the laser device being employed in communication with the user interface 13500. In the present embodiment, the second tab 13524 includes a “Sing” which represents that a laser device being

employed is enabled to establish a single laser beam. The third tab 13526 includes a “Plur” which represents that a laser device being employed is enabled to establish a plurality of laser beams. The third tab 13526 is shown without the horizontal line above it indicating that the laser device being employed may establish multiple laser beams. Thus, the pictorial representation 13580 is of a laser device establishing three laser beams. If the second tab 13526 was selected the pictorial representation 13580 includes a laser device emitting a single laser beam. In the present embodiment, the fourth tab 13528 is shown with no representation included. It is understood that the tabs may be variously configured and that in the various modes enabled by the user interface 13500 a tab may not provide a functionality. Further, it is understood that the user interface 13500 may enable a user to program various functionalities into locations, such as tabs, of the user interface 13500 without departing from the scope and spirit of the present invention.

[00263] FIG. 132 illustrates the user interface 13500 enabled in a “Camera” mode, as identified in the descriptive identifier region 13550. In the “Camera” mode the first display region 13542 establishes a picture representation 13582 of a camera device being employed in communication with the user interface 13500. In the present embodiment, the second tab 13524 includes a “Yes” which is a user selectable option. Thus, as shown in the present embodiment, if the user selects the second button 13510 it indicates to the user interface 13500 that a camera device is being employed and communication may be enabled or is to be established between the user interface 13500 and the camera device. The third tab 13526 includes a “No” which represents that no camera device is being employed. Thus, if the user selects the third button 13512, the user interface 13500 is instructed not to establish a communicative link with a camera device.

[00264] FIG. 133 illustrates the user interface 13500 enabled in a “Table Saw” mode, as identified in the descriptive identifier region 13550. In the “Table Saw” mode the first display region 13542 establishes a picture representation 13584 of a table saw being



employed in communication with the user interface 13500. In the present embodiment, the second tab 13524 includes a “Saw” which is a user-selectable option. Thus, as shown in the present embodiment, if the user selects the second button 13510 it indicates to the user interface 13500 that a table saw is being employed and communication may be enabled or is to be established between the user interface 13500 and the table saw.

[00265] The third tab 13526 includes a “Rout” which represents that a router is being employed. Thus, if the user selects the third button 13512, as shown in FIG. 139 a picture representation 13586 of a router is displayed in the first display region 13542. Additionally, the selection of the “Rout” tab indicates to the user interface 13500 that a router is being employed and communication may be enabled or is to be established between the user interface 13500 and the router.

[00266] The table saw mode enables the user interface 13500 to provide three available options, represented in the second tab 13524, third tab 13526, and fourth tab 13528. The selection of the second button 13510 which correlates with the second tab 13524 enables a distance reading as represented by the distance icon in the second tab 13524. The selection of the third button 13512 which correlates with the third tab 13526 enables an angle reading as represented by the angle icon in the third tab 13526. The selection of the fourth button 13514 which correlates with the fourth tab 13528 enables a height reading as represented by the height icon in the fourth tab 13528.

[00267] As shown in FIG. 134, the current-screen region 13540 includes the first mode icon region 13572 and the second mode icon region 13574 and their corresponding values. For example, as shown in FIG. 134, two operational mode icons are shown, each of which has at least one value. The two illustrated mode icons are distance 13576 and height 13577, each of which having a corresponding value, similar to that shown and described previously in reference to FIGS. 47 through 101, and may trigger the display of one or more additional screens, as described in more detail subsequently. Similarly, FIG.

140, directed to the router mode, displays first and second mode icon regions, however, these icon regions are height and diameter. It should be understood that the textual names for the modes may be used in place of or in conjunction with the mode icons. Additionally, although FIG. 134 and 140 shows a mode icon positioned below its corresponding value, other arrangements may be utilized as may be contemplated by a person of ordinary skill in the art. For example, a mode icon (and/or textual name) may be positioned to the left, to the right, or above its corresponding value without departing from the scope and spirit of the present invention. In the embodiments of FIGS. 135 and 136 the current screen region 13540 includes the operational mode icon 13578, displayed in both the first and second display mode icon regions. The mode icon 13578 represents the angle each of which has a corresponding value, similar to that shown and described previously in reference to FIGS. 47 through 101, and may trigger the display of one or more additional screens.

[00268] Preferably, the distance value, the angle (bevel) value, height value, and diameter value in the settings region 13560 are all displayed in a clear fashion to a user so that the user is not confused by the numbers inside these values. Different fonts, sizes, and/or color may be used to distinguish different numbers. It is understood that visual clarity and the ease with which an operator of the user interface 13500 may view the information presented on the display 13504 may implicitly establish a preferable range of fonts, sizes, and colors used by the user interface. Further, the amount of information to be presented on each screen of the display 13504 may determine/establish a range of fonts, sizes, and colors to be used. This is another example of the user focus of the present invention, making complex technology available in a simple and effective manner. If a number is presented as an integer plus a fraction, the integer may be preferably presented in a larger font than a numerator and a denominator of the fraction. For example, as shown in FIG. 134, the distance value is " $6^{1/8}$ ", in which the number " $6^{1/8}$ " is an integer "6" plus a fraction " $^{1/8}$ ", and the height value is " $1^{3/16}$ " in which the number " $1^{3/16}$ " is an integer "1" plus a fraction " $^{3/16}$ ". The integers "6" and "1" are presented in a larger font than the

numerators “1” and “3” and the denominators “8” and “16” so that a user is not confused by the numbers in the values. Moreover, if a value includes a decimal expansion of a number, the decimal digit(s) before the decimal point may be preferably presented in a larger font than the decimal digit(s) after the decimal point. It is understood that other methods as may be contemplated by a person of ordinary skill in the art may be used to distinguish numbers in a value so that a user is not confused by those numbers.

[00269] As shown in FIG. 137, the first and second descriptive identifier region 13552 and 13554, identify a “Camera View” and “Data”. Thus, within the table saw mode the first display region 13542 may be established with an image 13590 of the table saw provided by an imaging device. The second display region 13544, as shown in FIGS. 137 and 138, is enabled to display the second display regions settings 13564, sub-divided into sub-display settings regions 13565, 13566, and 13567. These sub-display settings regions may be enabled, as presently embodied, to display information relating to distance, height, and bevel measurements established. Further, as shown in FIG. 138, a “Finish Cut” may be established in the first descriptive identifier region 13552. Thus, within the table saw mode the first display region 13542 may be established with an image 13592 of the cut which may be established through a work piece. It is understood that the user interface 13500, in order to establish the “Finish Cut” image 13592, may include virtual imaging capabilities. As such the image 13592 may be a virtual image including various information, such as information relating to the angle of the cut, and the like. FIGS. 141 and 142 illustrate the user interface 13500 enabled similarly to that shown in FIGS. 137 and 138. However, the information provided is directed to height and the diameter of the cut established by the router.

[00270] Referring now to FIG. 143, an alternative exemplary embodiment of a power tool control system 14300 is shown. The power tool control system 14300 includes a graphical user interface 14302 which is enabled to couple with a base 14304. The graphical user interface may be disposed in operational communication with a non-

contact measurement and alignment device also coupled with the base 14304. The non-contact measurement and alignment device may be disposed within the base 14304. In a preferred embodiment, the non-contact measurement and alignment device is enabled with a laser source 14305 for emitting a laser beam and may be similar to the laser enabled capabilities described previously throughout the instant application. It is understood that the non-contact measurement and alignment device may be a modular device capable of being removed from and inserted into various base assemblies. The graphical user interface 14302 includes a housing 14306 which is disposed with a display 14308. The graphical user interface 14302 provides similar functionality as the graphical user interface described previously in the instant disclosure. The graphical user interface 14302, in the current embodiment, provides a first grip 14314 and a second grip 14316. The first and second grips are disposed upon the housing 14306, in the first grip region 14310 and second grip region 14312, respectively. It is contemplated that the first and second grips may be integrated with the first and second grip regions and/or removable from the first and second grip regions. The positioning of the first and second grip regions and grips may vary as contemplated by those of skill in the art. In a preferred embodiment, the first and second grip regions and grips are disposed on the housing 14306 in positions which may increase the ease of gripping the graphical user interface 14302 by a hand or hands of a user. The first and second grips may increase the comfort of grasping the graphical user interface 14302 by the user. The first and second grips may include a material, of various composition as contemplated by those of skill in the art, which may increase the comfort of grasping the graphical user interface 14302. Exemplary material for the first and second grips may be Sanoprene™, a registered trademark of Roush Industries. This may decrease fatigue in the muscles of the hand of the user associated with the operation of the graphical user interface 14302.

[00271] The dimensions of the graphical user interface 14302 may be established in conformance with ergonomic considerations. For example, the distance between the first and second gripping regions may be established in conformance with an average

hand size which establishes an average grip size. The distance established between the first and second gripping regions may determine a dimension, such as the width, of the graphical user interface 14302. However, various configurations of the graphical user interface 14302 may be established without departing from the scope and spirit of the present invention. For example, the housing 14306 may be contoured in various manners and the gripping regions may be established with aesthetic considerations in mind.

[00272] The display 14308 provides similar functionality and capabilities as those described previously with respect to the graphical user interface of FIGS. 1 through 142. In the preferred embodiment the display 14308 is configured to provide the maximum display area in conformance with the dimensions of the housing 14306. In this manner it may be seen that the display 14308 is established with a length greater than its width. This may have the effect of changing the display layout 14318 which is presented to the user of the graphical user interface 14302. The display layout 14318 enables a visual representation of the logically related folder functionality of the graphical user interface 14302. The segmenting of the display 14308 in order to enable the display layout 14318 may vary and be similar to the various display options described previously in this specification with respect to the graphical user interface described in FIGS. 1 through 142.

[00273] The graphical user interface 14302 further includes a selector 14320. The selector 14320 enables the user to access the various logically related folders and select from among the various functional capabilities enabled from these folders. In the preferred embodiment, the selector 14320 is positioned in an upper left hand corner of the housing 14306. This positioning may enable the user to engage the selector 14320 in a manner conducive to establishing and maintaining a firm grasp of the graphical user interface 14302. It is contemplated that the selector 14320 may be established in various locations upon the housing. For example, the selector may be located in the upper right hand corner of the housing 14306 or along a side of the housing 14306. The current

embodiment illustrates a scrolling selector including a wheel member which may be engaged by the user. In alternative embodiments, the selector 14320 may be enabled as a toggle switch, push button, and the like. It is further contemplated that the selector 14320 may be established as a plurality of selectable push buttons disposed along a side or top of the graphical user interface 14302.

[00274] As may be seen in FIG. 144 the housing 14306 may be disposed with various visual indicators to provide visual assistance to the user of the graphical user interface 14302. The number and location upon the housing 14306 of these various visual indicators may vary as contemplated by those of ordinary skill in the art. It is contemplated that the various visual indicators may provide guidance to the user as to which function is currently enabled upon the graphical user interface 14302. This may be accomplished through various display layout 14318 configurations. Further, the display 14308 may include additional features, such as the multiple pointers seen in the display 14308 of FIG. 144, which provide indication as to which functionality is enabled and what type of information is being provided with respect to that functionality.

[00275] It is contemplated that the display layout 14318 may be configured to correspond with the various visual indicators disposed on the housing 14306. It is further contemplated, that the graphical user interface 14302 may include an audio output capability. The audio output capability may be enabled through user selection enabled under a corresponding audio folder which presents audio options on the display 14308.

[00276] It is contemplated that the graphical user interface 14302 and the laser source 14305 of the base 14304 may be powered by various means. In the current embodiment, power is supplied through the use of batteries. The graphical user interface 14302 may provide on the display layout 14318 a monitoring of the battery levels of either or both the graphical user interface 14302 and/or the base 14304. The batteries may be standard batteries, re-chargeable batteries, and the like. Further, power may be supplied by a

power cord connected to a power source, a solar cell, or various other power sources as contemplated by those of ordinary skill in the art.

[00277] The graphical user interface 14302 may be enabled with the ability to communicate with other information handling devices, such as computers. The communication link may be established using various communication technologies. In a preferred embodiment, the communication link is established using wireless technology. The wireless link may utilize one of the many wireless technology standards currently employed. In alternative embodiments, the communication link may be enabled through a wired connection. For example, the graphical user interface 14302 may include an adapter port for connecting with a serial cable. The serial cable thereby providing the communication link when it is connected with other information handling devices.

[00278] The base 14304 includes a housing 14330 which is enabled to be coupled with and removed from various devices, such as a fence of a table saw. Further, the housing 14330 includes the laser source 14305 disposed within. The laser source 14305 may be of various configurations and may be enabled to emit laser beams of various configurations. It is contemplated that a tracking system, such as a light emitting diode, may be operationally coupled with the laser source 14305, such that when the laser beam is emitted the light emitting diode emits a visible light which identifies the path of the laser beam. Other technologies for providing visual indication of the laser beam may be employed without departing from the scope and spirit of the present invention. In further alternative embodiments, the laser source may be disposed within the graphical user interface 14302.

[00279] The housing 14330 of the base 14304 may include a first window 14332 and/or a second window 14334. The first and second windows may be disposed within the housing 14330 in positions which enable the emission of the laser beam from the laser source 14305. The first and second windows may be variously configured to

accommodate the needs of the user and/or the machine with which the laser source may be operating with. The windows may be circular in shape, rectangular in shape, or assume various other geometric patterns.

[00280] The dimensions of the housing 14330 may be varied to accommodate its coupling capabilities with various devices. The housing 14330 includes a top surface 14336 which may be enabled to couple with the graphical user interface 14302. The coupling may occur via a magnetic system which binds the housing 14306 of the graphical user interface 14302 with the top surface 14336. Other coupling systems may be employed, such as a compression lock system, latch system, and the like, as contemplated by those of ordinary skill in the art. The coupling of the graphical user interface 14302 with the top surface 14336 of the housing 14330 may be a removable coupling. Thus, the graphical user interface 14302 may be operated, remote from the base 14304.

[00281] The graphical user interface 14302 is communicatively coupled with the laser source 14305 disposed within the housing 14330. The communicative link may be established using various communication technologies as contemplated by those of ordinary skill in the art. In preferred embodiments, communication is established using a wireless communication technology. It is understood that various wireless technologies may be employed to accomplish the communications link. The wireless communications link enables the graphical user interface 14302 to control operation of the laser source 14305 from various remote locations. Alternatively, the graphical user interface 14302 may be hard wired to the laser source 14305.

[00282] The base 14304 further includes a latch assembly. The latch assembly is disposed upon the housing 14330 in a position which enables it to engage with the mechanical device to which the user wishes to connect the base 14304. In the preferred embodiment, the latch assembly includes a handle 14340 operationally connected with a T-slot screw 14342. The handle 14340 enables a user of the latch assembly to tighten or loosen the T-



slot screw 14342, thereby, tightening or loosening the connection between the base 14304 and the mechanical device. In the preferred embodiment, the mechanical device is a fence 14350 which is typically used with a table saw system. The fence 14350 defines a recessed area 14352 which typically runs the length of the fence 14350. The housing 14330 of the base 14304 is configured to insert within the recessed area 14352 of the fence 14350. Once inserted, the user may engage the handle 14340 to tighten the T-slot screw 14342 against the fence 14350. Once tightened, the base 14304 is securely fastened within the recessed area 14352. It is understood that the base 14304 may be moved within the recessed area 14352 and secured in various alternative positions along the length of the fence 14350. The base 14304 may be slid within the recessed area 14352 or removed and re-positioned by re-inserting the base 14304 within the recessed area 14352 in an alternative location. Additionally, the base 14304 may be inserted into the recessed area 14352 in various orientations relative to the fence 14350. For example, the base 14304 may be inserted in a first position facing a first direction and then removed and re-inserted in a second position facing a second direction. Thus, the base 14304 is reversible in its insertion positioning within the recessed area 14352 of the fence 14350.

[00283] In the exemplary embodiments, the methods disclosed may be implemented as sets of instructions or software readable by a device. Further, it is understood that the specific order or hierarchy of steps in the methods disclosed are examples of exemplary approaches. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the method can be rearranged while remaining within the scope and spirit of the present invention. The accompanying method claims present elements of the various steps in a sample order, and are not necessarily meant to be limited to the specific order or hierarchy presented.

[00284] It is believed that the present invention and many of its attendant advantages will be understood by the forgoing description. It is also believed that it will be apparent that

various changes may be made in the form, construction and arrangement of the components thereof without departing from the scope and spirit of the invention or without sacrificing all of its material advantages. The form herein before described being merely an explanatory embodiment thereof. It is the intention of the following claims to encompass and include such changes.